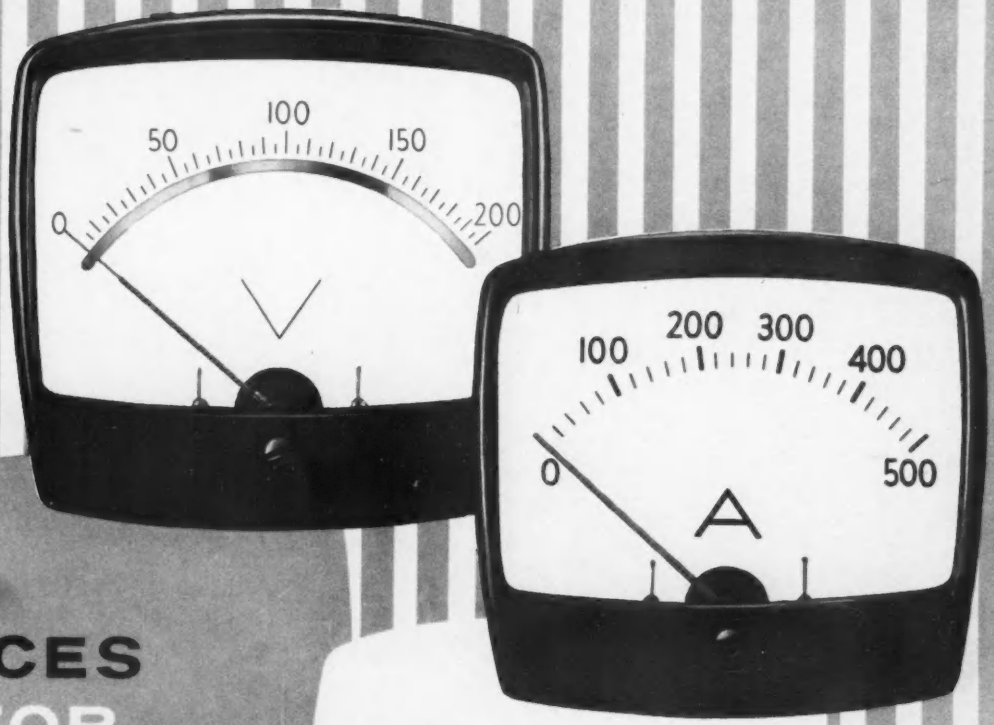
23 NOVEMBER 1961

ONE SHILLING AND SIXPENCE

# ELECTRICAL TIMES




FACES FOR CASES

Elegant cases and legible faces give these Ferranti Style 'A' instruments a contemporary look but they are more than good looking! Robust in construction, and designed to give minimum rear projection, they are interchangeable with standard 2½" and 3½" round flush instruments and are available with fine scale with or without mirror or bold scale.

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FIRST INTO THE FUTURE

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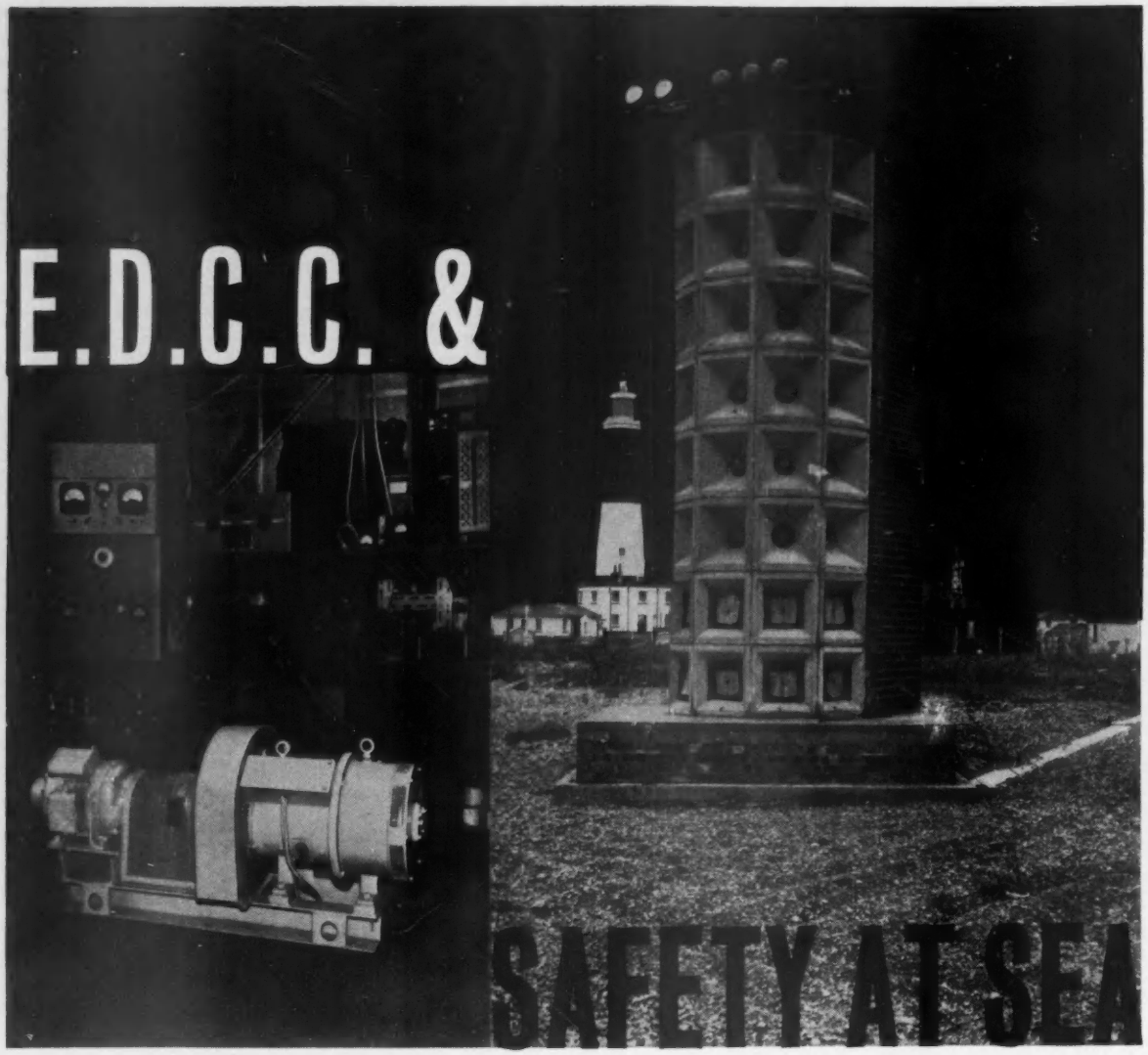


Special motor-alternator set providing a three-frequency output.

E.D.C.C. are manufacturers of:

| | |
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| Dynamometers | HF alternators |
| Rotary convertors | Voltage stabilisers |
| Flame-proof marine motors | Rotary transformers |
| Frequency changers | Battery traction motors |
| Induction regulators | D.C. generators |
| Single and polyphase alternators | Magnetic couplings, Control gear, etc. |

The custom-built Triple Frequency Generator supplied for the Trinity House Experimental Station at Dungeness is yet another example of Electro-Dynamic special purpose equipment. This generator is used for energising experimental fog-signalling equipment. It comprises three alternators in a common casing, having 16, 22 and 28 poles respectively and is driven by a 2-pole induction motor, through a magnetic-particle type coupling and flywheel.

ELECTRO-DYNAMIC

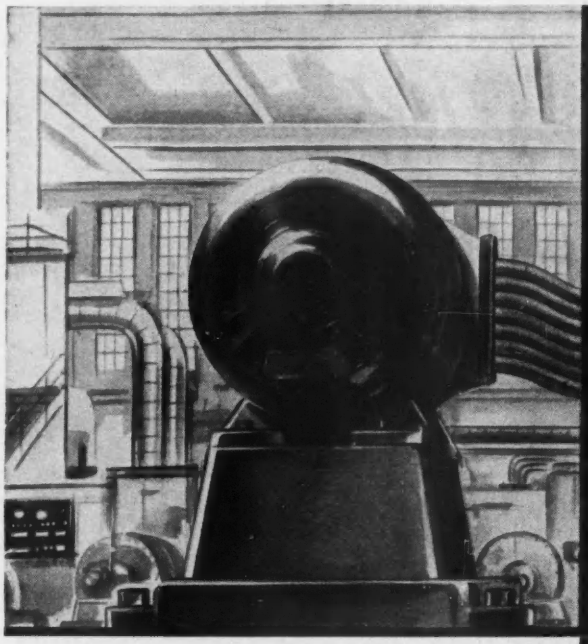
**CONSTRUCTION COMPANY LIMITED**

**ST. MARY CRAY ORPINGTON KENT TELEPHONE: ORPINGTON 27551 TELEGRAMS: ELEDAMIC ST. MARY CRAY**

*Control Gear Division: Bridgwater Somerset Telephone: Bridgwater 2882 Glasgow Office: 40 Houldsworth St C3 Telephone: Central 2620*

P.5657

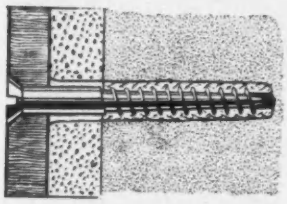
# FASTENING HEAVY EQUIPMENT
## FIXING LIGHT COMPONENTS



## RAWLBOLTS

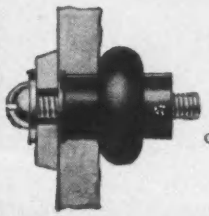
Where a bolt fixing is necessary or where extra heavy loads are involved Rawlbolts are the perfect fixing. They require no grouting, are instantly locked in the hole and enable machinery to be put into operation immediately. There are two types — loose bolt and bolt projecting to suit the nature of the job. Sizes are from ⅜" to 1" in various lengths.

## RAWLPLUGS

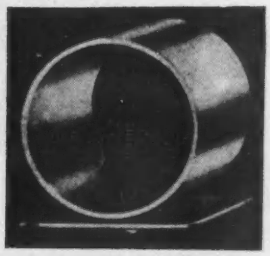


For screw fixings in solid materials Rawlplugs will take loads up to a million times their own weight. The tiny No. 3 (¼") is used for fixing cable clips, the largest No. 30 (1") for fixing electrical and other gear to walls or floors will take direct loads up to four tons.

## RAWLNUTS



In the range of Rawlplug Cavity Fixings the RAWLNUT has almost every advantage. It will make blind fixings in the thinnest of 'shell' materials, or in the larger sizes is suitable for hollow pot, or friable composition materials which will not hold conventional fixings. In situ it is vibration proof, waterproof, airtight, and insulative. It is extensively used in aircraft and car assemblies. There are sizes from ¼" BSW to ½" BSW and alternative threads.



*The illustration here shows how it is possible to fix a metal plate to a tube. It is also possible to stop a leak in a tank.*

RAWLPLUG

**THERE ARE 24 DIFFERENT TYPES OF**

**FIXING DEVICES FOR SPEED AND ENDURANCE**

THE RAWLPLUG COMPANY LTD., CROMWELL ROAD, LONDON, SW7

***THE WORLD'S LARGEST MANUFACTURERS OF FIXING DEVICES***

9718

A

# HURSEAL TURNS ON THE HEAT WITH A NEW ALL-COLOUR ADVERTISING CAMPAIGN

Hurseal decor-designed

**ELECTRIC PANELS permanently oil-filled**

Through the medium of the Home Magazines, Hurseal are urging readers to BE MODERN MINDED ABOUT HEATING. The powerful selling points which are being driven home are these . . .

* Contemporary decor-designed panels to harmonise with home decoration.
* Any length supplied to specific requirements (Conforming to the principle that radiators *must* be full window width for maximum efficiency).
* Safety—no risk of fire, burns or scorching.
* Economy—NO BIG OUTLAY OR INSTALLATION PROBLEMS.

The HURSEAL PORTABLE MODEL will be specially featured this Autumn—it *can* be your customers' first step to complete home-heating the simple Hurseal way. So keep one on display. And, remember, that although standard colours are bronze and cream, Hurseal Panels can be supplied in any B.S.S. Colours.

**POWELL DUFFRYN HEATING LTD**
VALE ROAD, CAMBERLEY, SURREY

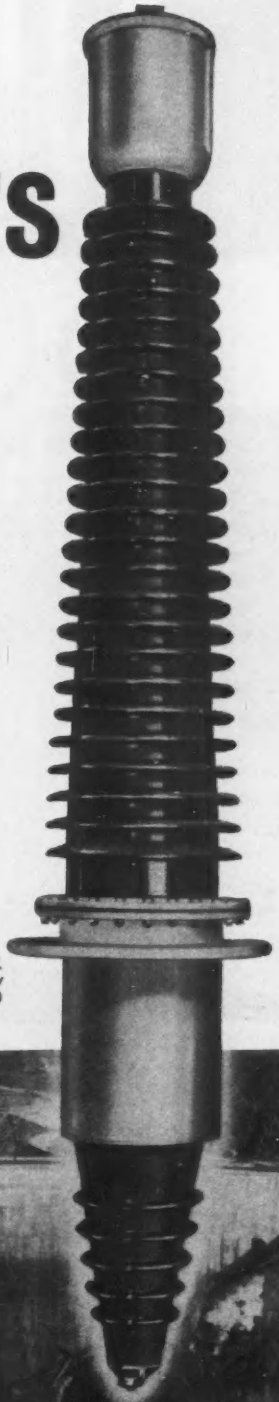
*MAIN CONTRACTORS:* A.E.I. Ltd.
*CONSULTING ENGINEERS:* Merz & McLellan

# insulating KARIBA'S giant power 330 kV

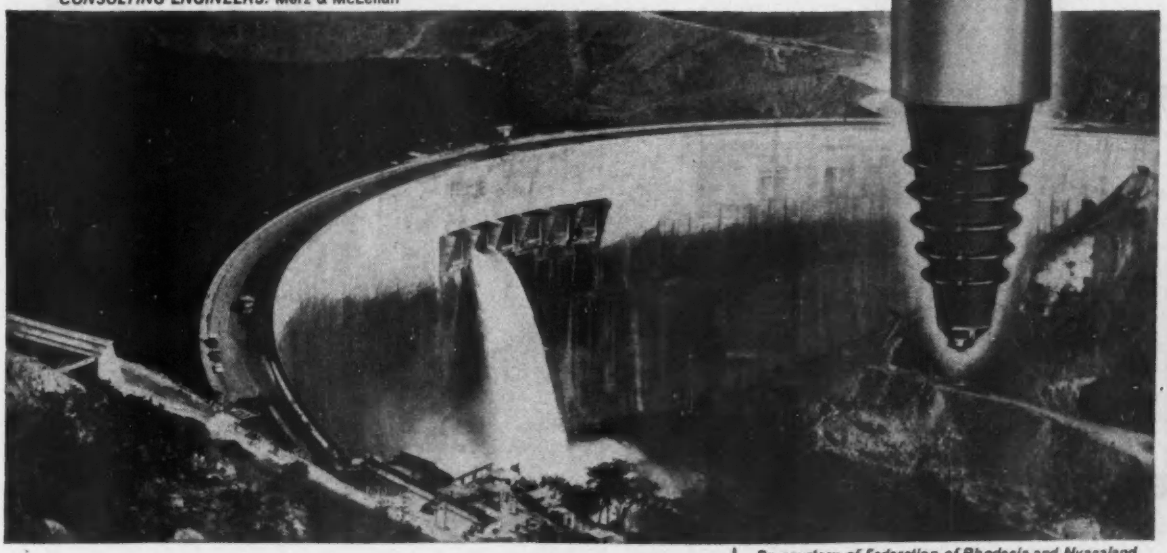
All the bushing porcelains for the 330 kV. circuit breakers, all the 330 k.V. strain insulators for the substations, and the 330 kV. post insulators for some of the substations were supplied by

# BULLERS

*Units of the switch gear on the south bank. Power for the Copperbelt and for Southern Rhodesia passes through this stage.*



*A complete 330 kV. bushing insulator (by courtesy of A.E.I. Ltd.)*



**BULLERS LIMITED · MILTON · STOKE-ON-TRENT · STAFFS**
*Telephone:* Stoke-on-Trent 54321

*By courtesy of Federation of Rhodesia and Nyasaland*
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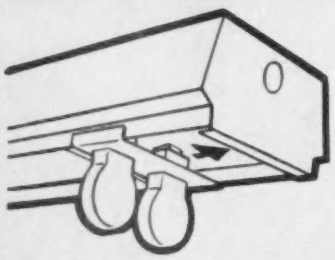
# NEW

# DURHAM RANGE

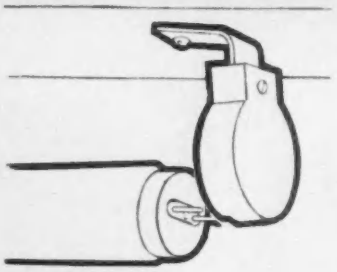
## Lighting Fittings

**A complete and compact range produced by**

**EKCO**



**LAMPHOLDER PLATFORM**
Platform locked into position without tools. Lampholders cannot be reversed on twin fittings.



**LAMPHOLDERS**
White, plastic, sprung, bipin for positive easy operation. Relamping from either end of fitting.

**with easy-to-fit, easy-to-operate lampholders—just two of the many new features of this outstanding range of lighting fittings**

**Ekco-Ensign Electric Limited** *45 Essex Street, Strand, London WC2 Telephone CITY 8951*

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Well, why not . . . he'll do the back lawn in next to no time with that fine new mower. It's all part of the good life he's come to expect. But do you know the part that pressure die castings play in that good life? We hardly expect you to. Let's just say that they're inseparable from it. Wolverhampton pressure die castings offer manufacturers high quality components at remarkably low cost in a variety of pleasing finishes. And the massive scale of production that can be achieved helps everyone to enjoy a higher standard of living. Wolverhampton pressure die castings in zinc and aluminium point to progress in a big way. Your enquiries would be welcomed.

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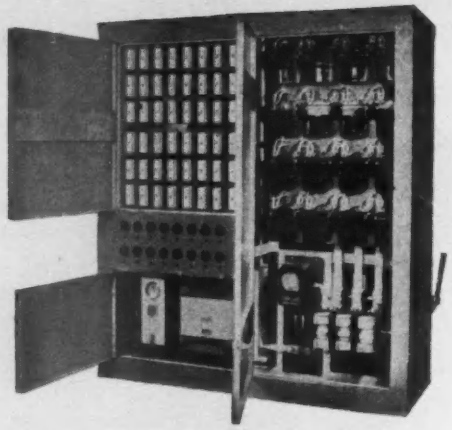
*built to individual Specifications*



## THERMAL STORAGE HEATING

With the special off-peak tariffs now available through the electricity authorities the overall cost of thermal storage space heating has been reduced to a most economical figure. We are specialists in the design and manufacture of automatic panels for space heating control and have supplied panels handling up to 500 kW.

The panel illustrated handles 267 kW and is divided into 16 zones with individual limit thermostats and overall control by time-switch, together with anticipatory control unit. We shall be most happy to quote for your automatic control panel.

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Comprehensive range of contactors for all types of thermal storage and space heating control—10 to 350 amp. SINGLE, DOUBLE, TRIPLE AND FOUR POLE.

FOR SILENT OPERATION. All models can be fitted with D.C. operating coil and rectifier.

*Type* D10 60. *4-Pole, 60-Amp, in steel housing.*

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**To BRITISH KLOCKNER SWITCHGEAR LIMITED**

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Please send me your list of Contactors for Heating Control.

**NAME** .....

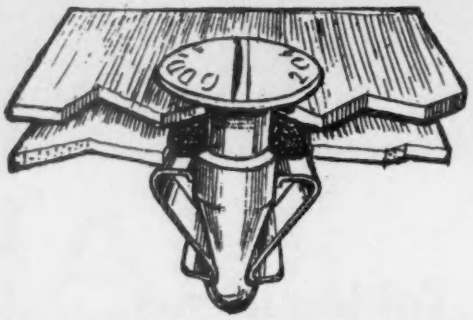
**POSITION** .....

**FIRM** .....

**ADDRESS** .....

E.T.

# ODDIE FASTENERS



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**SIMPLE—POSITIVE—SELF LOCKING**

Made in a variety of types and sizes

**SPECIAL FASTENERS TO SUIT CUSTOMERS' REQUIREMENTS**

Widely used in the Electrical Industry

**DEPT.: E.T.**

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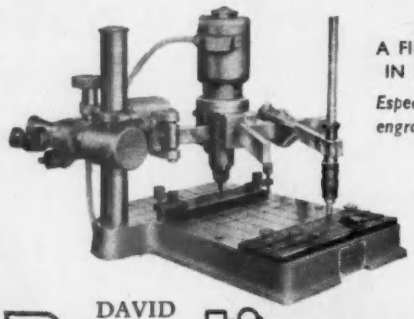

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*Especially suitable for engraving labels, etc.*

DAVID **Dowling** model **848**

Reduction range 2: 1 to 4: 1. Vertical adjustment to suit workpiece height. Coverage from 5in. × 3in. to 2½in. × 1¾in.

Write for details of our complete range of engraving equipment.

**DAVID DOWLING LIMITED · HAROLD WOOD · ROMFORD**

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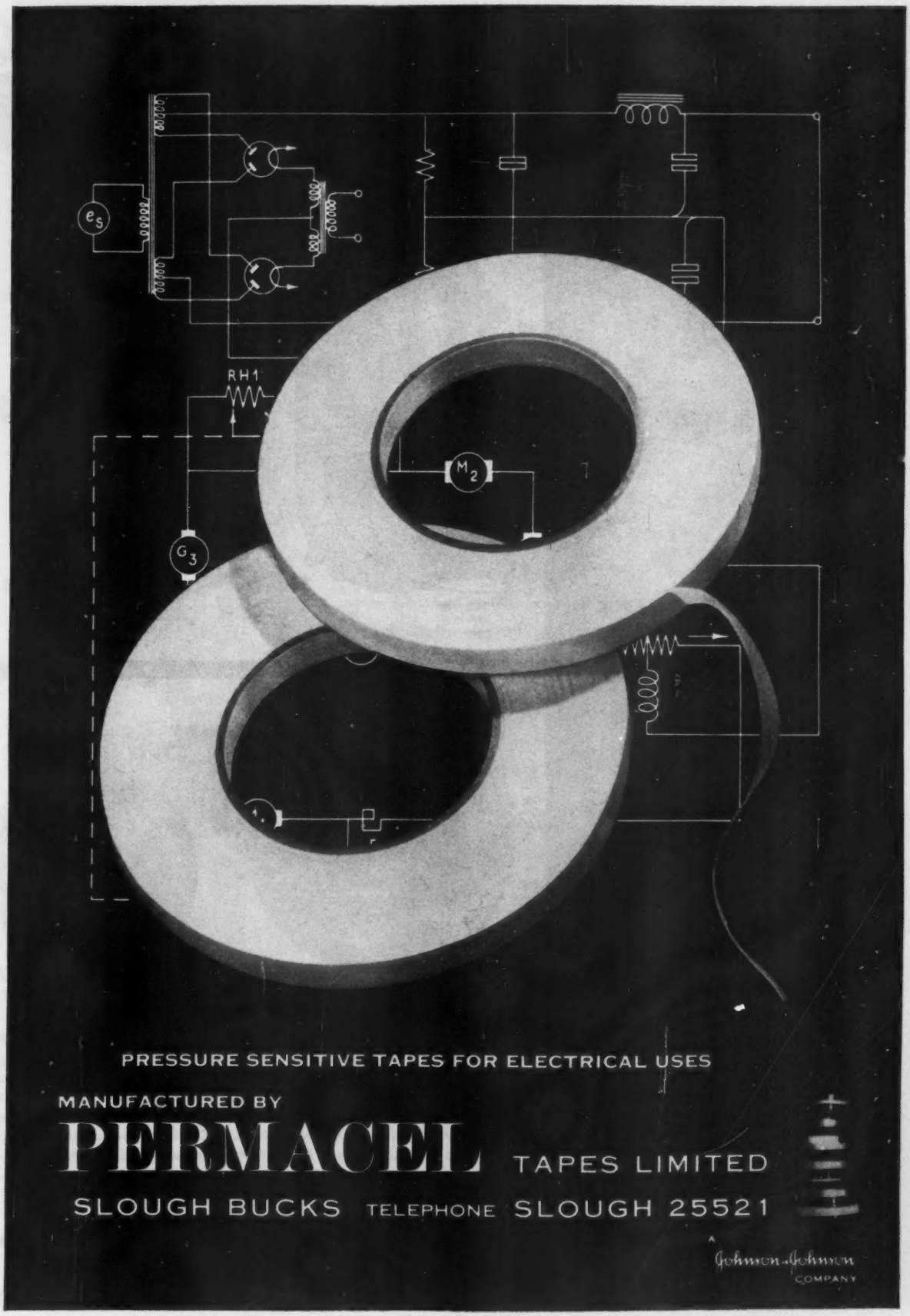


PRESSURE SENSITIVE TAPES FOR ELECTRICAL USES

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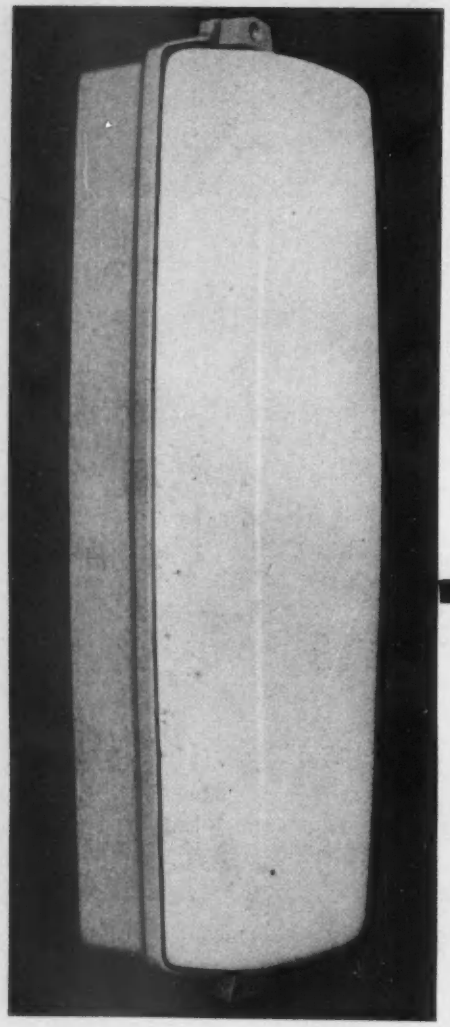
PERMACEL TAPES LIMITED

SLOUGH BUCKS TELEPHONE SLOUGH 25521

A Johnson & Johnson COMPANY

# BULKHEAD & FITTINGS BY



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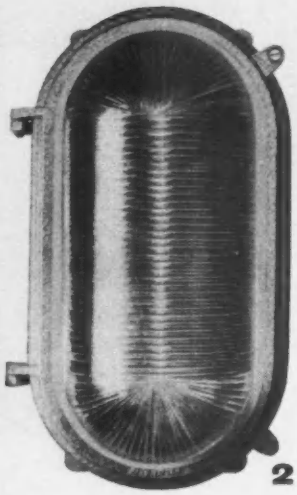

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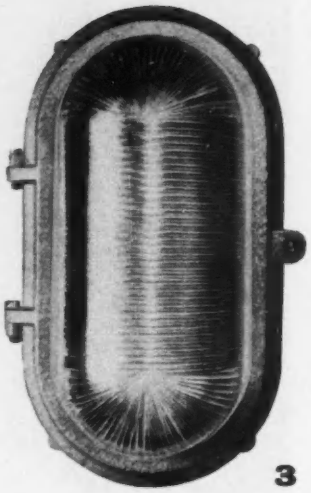

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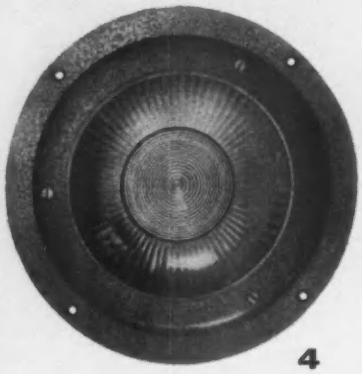

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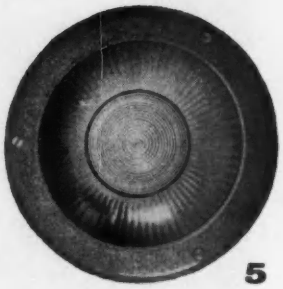


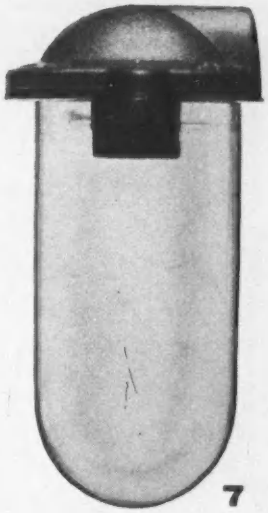
5

The Revo range of high quality Bulkhead fittings is designed to operate in all kinds of adverse weather conditions for long periods and with a minimum of maintenance. Selected from this range are: 1. Fluorescent Bulkhead for 12" tubes (one, two or three) with acrylic plastic cover. 2. Aluminium and 3. Cast Iron Bulkheads (the latter galvanised if required) for 150 watt lamps. Prismatic glass covers. 4. Recessed and 5. Surface mounted "Silver Ring" Bulkheads. Choice of opalescent, or axial or symmetric prismatic glass fronts. All are finished in hammered grey stove enamel. Our illustrated leaflet gives full information.

**REVO ELECTRIC CO. LTD., TIPTON, STAFFORDSHIRE**

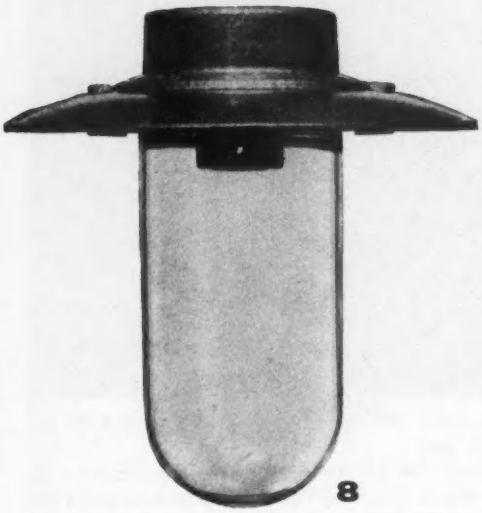
# WELLGLASS
# REVO ELECTRIC

6



7

Four standard fittings (Nos. 6, 7, 8 and 9) are illustrated on this page and each is available in either Die-cast aluminium alloy or cast iron, Stove enamel hammered grey finish or galvanised cast iron. Clear wellglass is mounted on a rubber seating washer and is located by two fixing lugs designed to allow removal of glass without detaching screws. 40, 60 or 100 watt tungsten lamps are suitable for these fittings. Wire guards and matching backplates and brackets are available if required. For full details refer to our leaflet which is obtainable from the address below.



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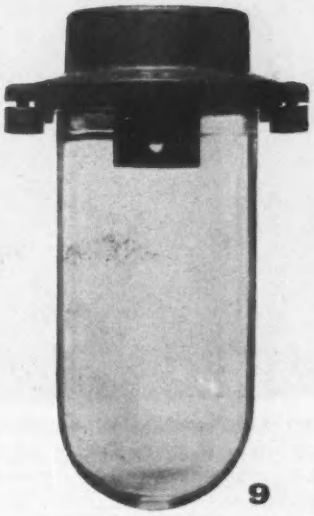
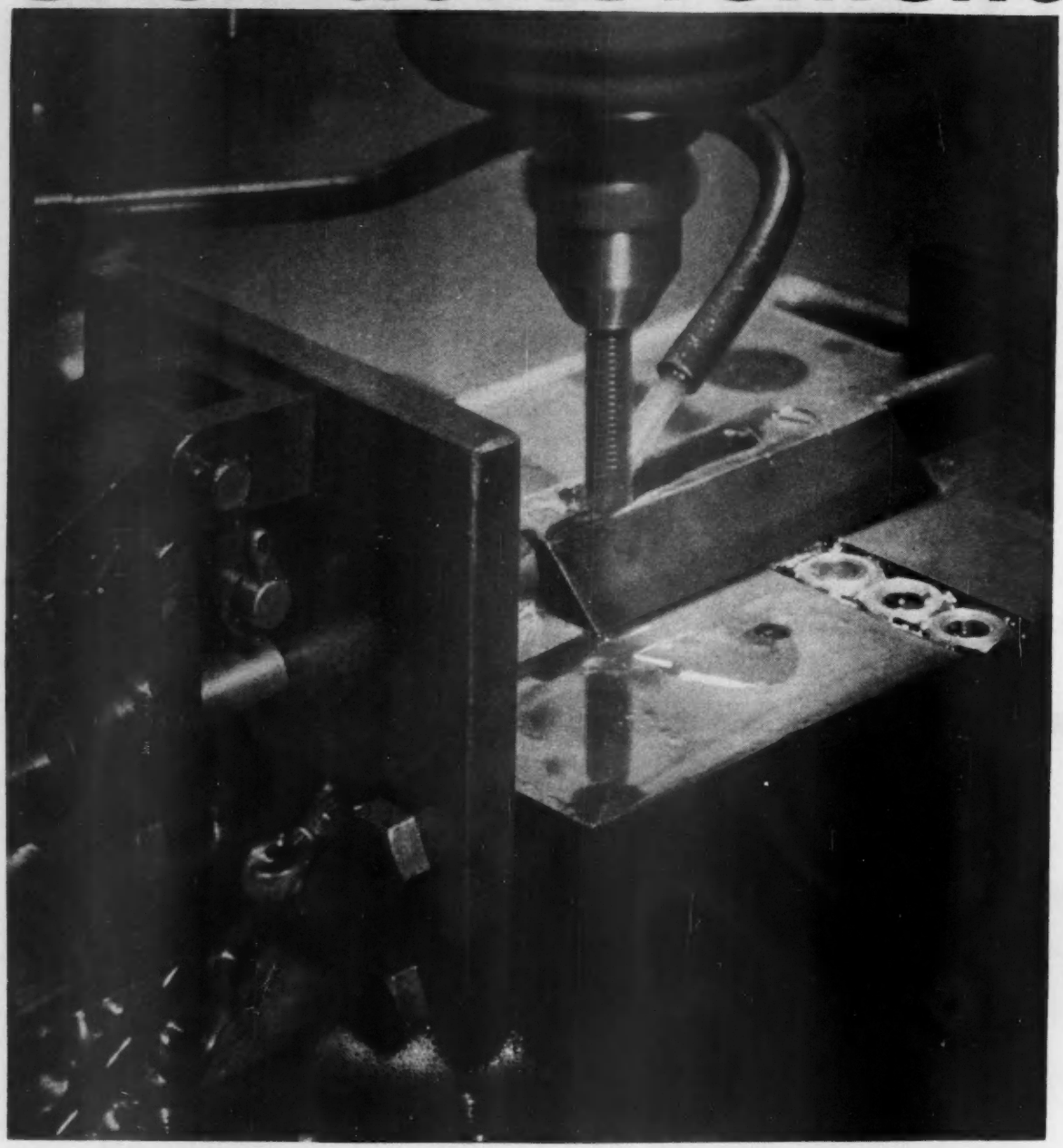


9

*A Duport Company famous for cookers, fires, fluorescent and industrial light fittings, street lighting, switch and fusegear, etc.*

W & W 89

# Shell achievement



A famous aero-engine firm found it could drastically reduce the cost of producing nuts made from S.62 steel, by changing over from conventional cutting oils to Shell Garia Oil 115. The facts are these. S.62 steel is heat-resistant and stainless. The quality of this steel and the call for very fine tolerances, as well as a very high percentage of full depth of thread, presented costly manufacturing problems. The breakage of taps, the need for constant re-setting, and the high proportion of rejects, built up the average cost of the nuts to over 1s. 2d. each.

By accepting the advice of the Shell engineer and changing over to Shell Garia Oil 115, this firm was able to produce 3,000 nuts between regrinding taps-resulting in the cost of each nut being reduced to 3d. *Write for the booklet 'Selecting Your Cutting Oils' to Lubricants Dept., Shell-Mex House, London, W.C.2.*

SHELL

# SHELL INDUSTRIAL OILS

RADIOVISOR EST. 1927

* P.E control

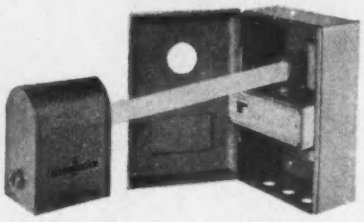
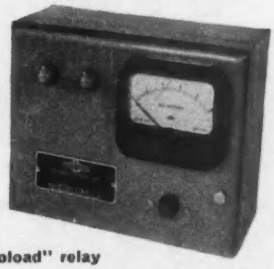
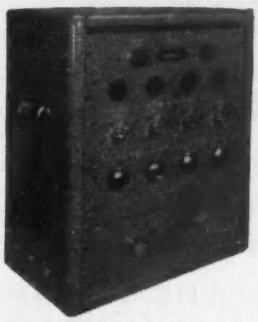


**Photo-electric relay type Q.56**
Uses include:—on-off switching; automatic spraying; length cutting gauge; conveyor control; process control; height gauge; limit switch; loop control; warning device; paper breakage indicators; alarms, etc. etc.



**"Motoload" relay**
Many factors can be measured or guarded against by keeping a check on the current of a driving motor. The Relay senses the torque of a driving motor and responding immediately to load variations, switches off the motor, indicates the variations or performs some other desired operation.



**Counting and batching**
Counting rates up to 20,000 per minute can be recorded and batching units divert succeeding articles after a chosen number has passed through the light beam.

*
Photo-electric control helps *you* speed production, increase efficiency, cut costs.

P. E. RELAY

MOTOR LOAD CONTROL

COUNTING CONTROL

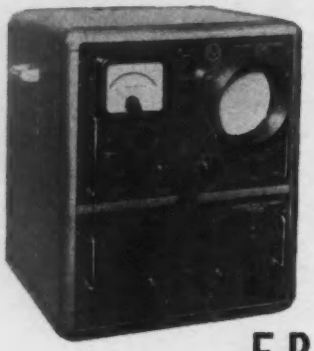
RADIOVISOR P.E control

**MAKERS OF THE MOST COMPREHENSIVE RANGE OF PHOTO-ELECTRIC CONTROLS IN THE WORLD**

*Radiovisor photo-electric and electronic controls include:*

**Flamestat Flame Failure Control • Smoke Detector Fire Alarm Sequence Control • Counting and Batching Unit • Invisible Ray Burglar Alarm • Turbidity Equipment • Hopper and Bunker level Control • Print Registration • Photo-electric Safety Guard • Factory Lighting Control • Automatic Radiation Pyrostat • Automatic Door Opening • Industrial Smoke Density Indicator and Alarm Resistance Welding Control**

**RADIOVISOR PARENT LIMITED,** Stanhope Works, High Path, London, S.W.19
Telephone: CHErrywood 3351 Telegrams: Radivisor, London, S.W.19



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If you are concerned with research or the manufacture of cables, transformers, capacitors, dielectric materials, insulating materials, electric motors, switchgear, electronic components etc.

**these instruments are important to you!**

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*CONTACT US FOR FULL DETAILS **NOW!***

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***are essential for efficient electrical connections***

TYPE AB — CODE: 157 LAA-1AB

- Four basic types covering all electrical requirements.
- For circuits up to 450 volts a.c. or d.c.
- Current rating: up to 5 Amps with removable plug: up to 30 Amps with captive link.
- Tailored for wall mounting junction boxes, cable terminating cubicles, rack-mounted systems, apparatus cubicles.
- Units made up to any requirement.
- Removable link plug enables easy current measurement.
- Delivery four weeks.

**Write for brochure R/117, Terminal Link Panels.**

62/3R

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ELECTRICAL ENGINEERS EXHIBITION · EARLS COURT 1961

# 12,000 x 112 x 16 = 21,504,000

This simple calculation helps us to arrive at an interesting comparison. It shows that the weight (16 cwt) of the largest insulator displayed on our stand at the 1961 Electrical Engineers Exhibition, was **21½ million times** the weight of the smallest (12,000 per lb.)

This is just to give some idea of the vast range of porcelain insulators we manufacture. Large or small, each TT product is the result of the finest research, manufacturing and testing techniques appropriate to its class.

## TAYLOR TUNNICLIFF & COMPANY LIMITED

Head Office: EASTWOOD · HANLEY · STOKE-ON-TRENT · Telephone: Stoke-on-Trent 25272/5

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**If you have a problem**
concerning switching, counting, lighting, batching, register, density, positioning or thickness control

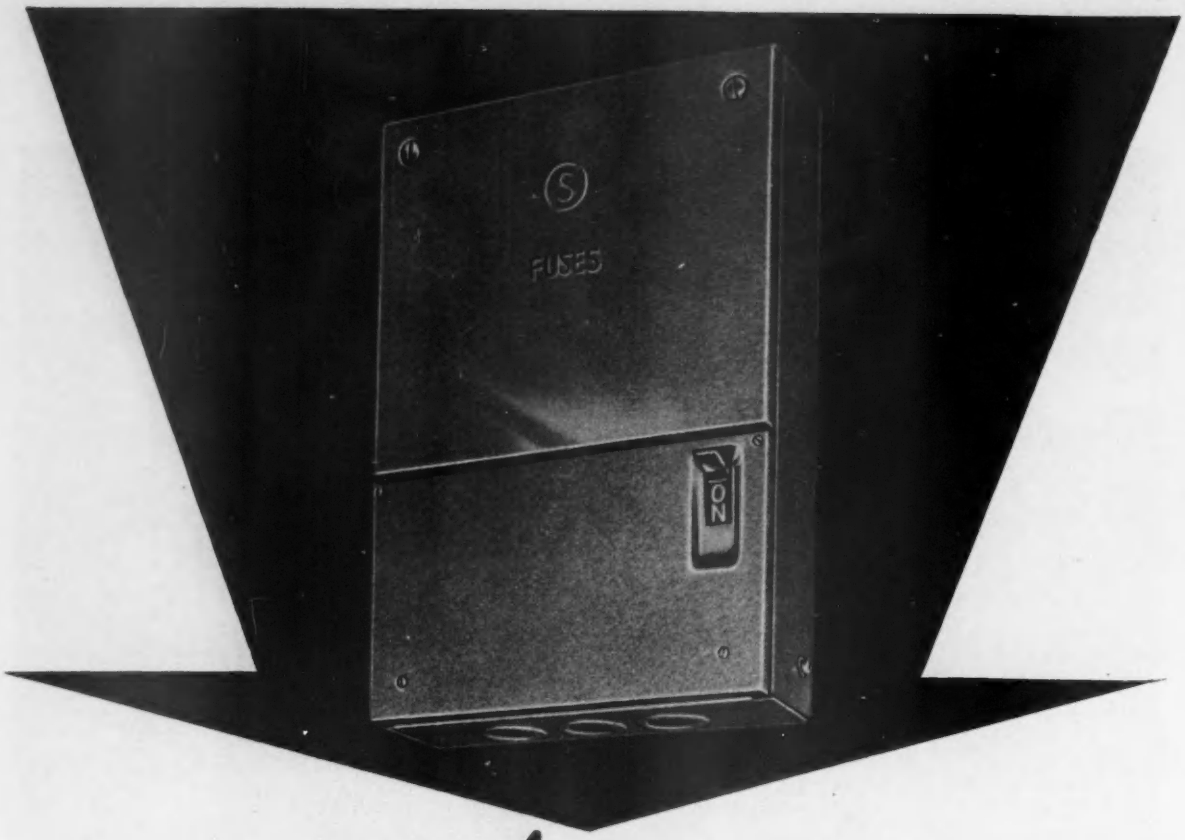
**which photosensing might solve**
with any of the extensive range of units shown here, and the accumulated experience behind them,

**then write to us,**

**LANCASHIRE DYNAMO ELECTRONIC PRODUCTS LIMITED** RUGELEY·STAFFS

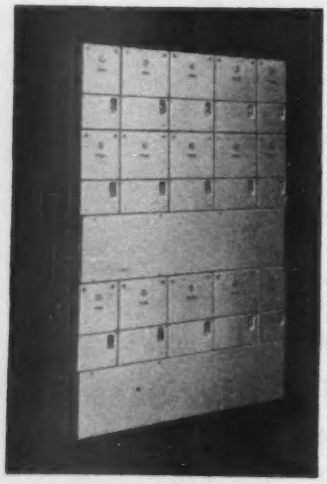
Metal Industries Group

SP22




# *and now—*

# the outstanding new SANDACEE range of A.C. switch fuses



Build your switchpanels into compact space-saving units with SANDACEE A.C. Switch fuses. Smooth projection-free casing permits any form of unit assembly without spacings. Features include fully interlocked front-operated switch having heavy duty solid silver contacts and with ON/OFF indicator.

"Sandaspeed" Duplex fuse units with inter-changeable, re-wireable, or H.R.C. Carriers throughout the range.

Neat modern design, complying where applicable with B.S. 2510 and B.S. 861, affords ample wiring space for fully universal wiring with maximum size cable. Available in S.P. & N., D.P., T.P., T.P. & N. 15, 30, 60, 100 Amp. 440 v. A.C. only.

Send for leaflet No. 162/61.

**SANDERS**

WILLIAM SANDERS & CO. (WEDNESBURY) LTD.
FALCON ELECTRICAL WORKS,
WEDNESBURY, STAFFS.

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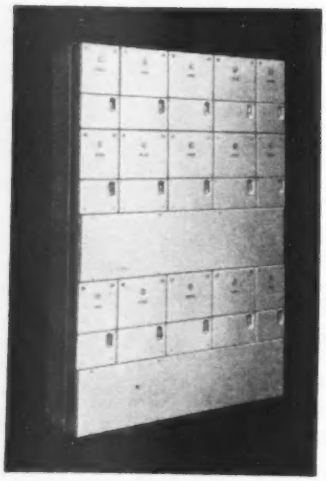

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# A WIDE RANGE
## OF ELECTRICAL DISTRIBUTION EQUIPMENT

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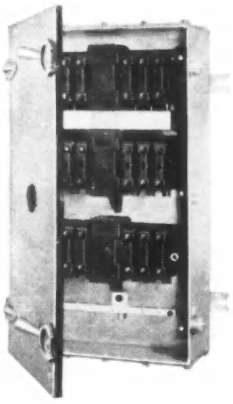
**(35 MVA at 440 Volts A.C.)**

**'RED SPOT' H.R.C. FUSE FITTINGS**



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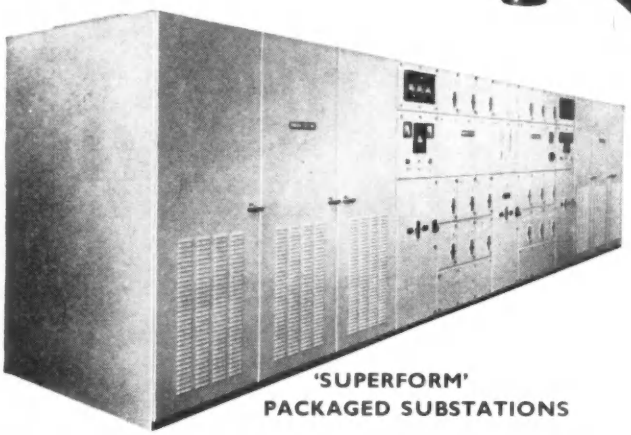

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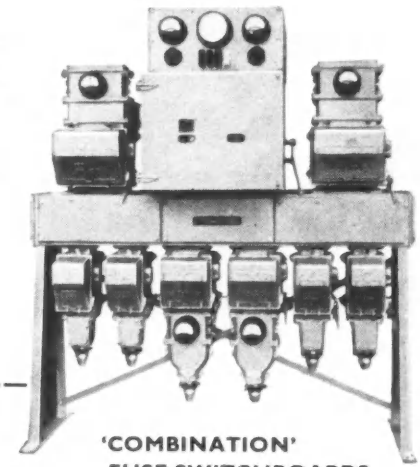

**'COMBINATION' FUSE-SWITCHBOARDS**

**'ENGLISH ELECTRIC' manufacture:**

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*Trade marks of 'ENGLISH ELECTRIC'

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**fusegear**

**FUSEGEAR DIVISION, EAST LANCASHIRE ROAD, LIVERPOOL 10**

The English Electric Company Limited, English Electric House, Strand, London, W.C.2

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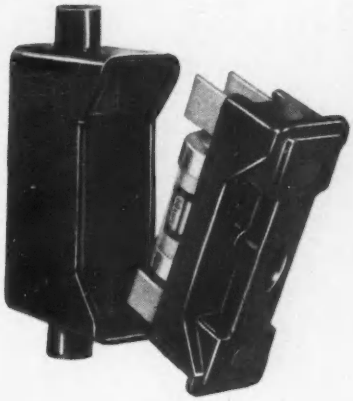

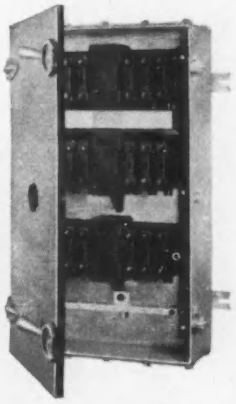

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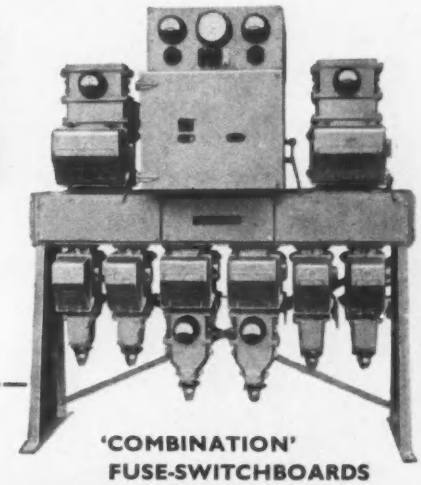

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## TERMINAL BLOCKS
### *IN MOULDED NYLON*

- Designed for simple and economical grouping of any number of ways.
- Extra ways can be added without dismantling or further drilling.
- Only two fixing screws required up to 12 ways.
- Transparent covers and name strips available.
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- Tested to 4000 V. between terminals and to earth.
- Available with 0 B.A. and 2 B.A. studs.
- Moulded in NYLON, highly resistant to tracking and virtually unbreakable.
- Approved by C.E.G.B.

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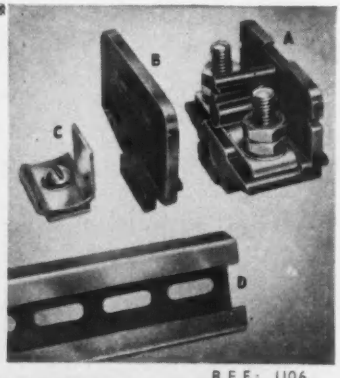
**A** Body in moulded Nylon with brass connecting link with either 2 B.A. or 0 B.A. studs.

**B** Moulded Nylon barrier. Required only at one end of group.

**C** Cadmium plated steel end clamp, one required at each end of group.

**D** Cadmium plated slotted steel channel.

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**5-300 amp. 250-500 volt.**
(single pole up to 600 amp.)

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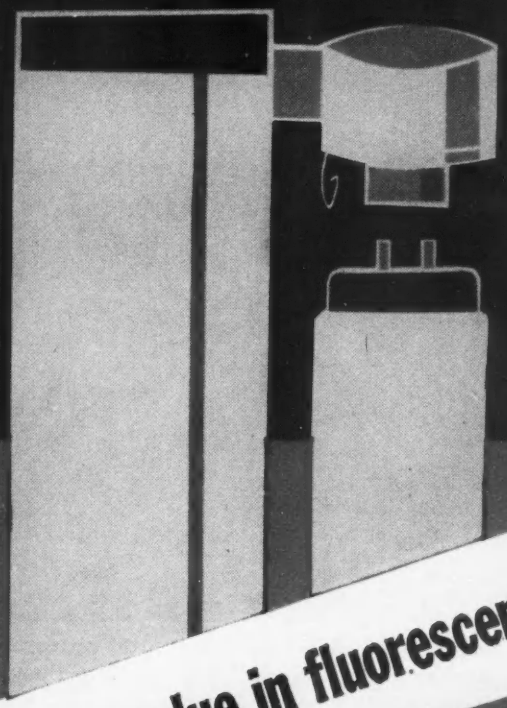
G.E.C. LIGHTING AND HEATING GROUP



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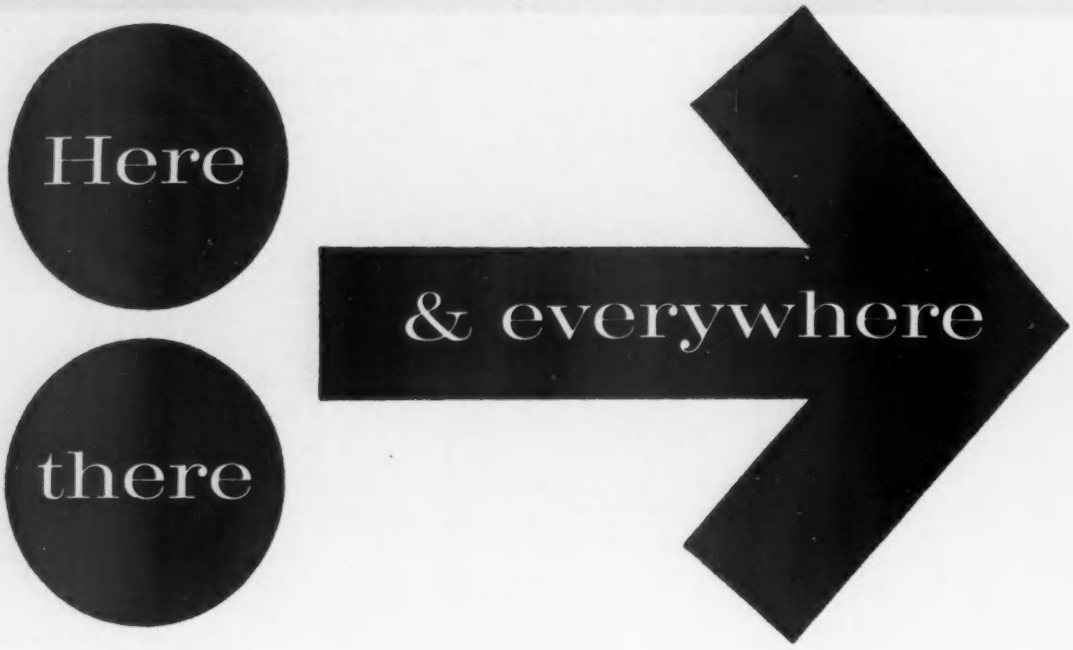
Complete in one pack, the answer to a thousand-and-one lighting problems. Full range of sizes: 2 ft. (single or twin), 4 ft. (single), 5 ft. (single or twin), 8 ft. (single or twin), with good looking easy-to-fix reflector and diffuser attachments. Instant start for 4 ft. and 8 ft. sizes. Remember—Slim Jim comes out of the pack almost ready to light up.

Slim Jim must be your fastest-selling most profitable fluorescent unit because it is the easiest to fit, the most attractive in design, and the finest all-round value for money; and because full scale national advertising supports you all the way. Ask your local G.E.C. office or showroom for full details now.

LIGHTING & HEATING GROUP
THE GENERAL ELECTRIC CO. LTD
MAGNET HOUSE, KINGSWAY, WC2

# Class H




Class H and Class C silicone-insulated dry type transformers are in the centre of things nowadays—in general use *at load centres*. And it doesn't matter if it's on the 1st or the 17th floor, in the factory roof or next to the warehouse. Class H and C dry-type transformers are *safe*—anywhere. Not affected by dust or humidity. Fire and explosion proof. And because they withstand repeated overloading, ratings need not be based on peak loads.

Among the leading firms and organisations using Class H and C transformers are *Shell, Unilever, The Steel Company of Wales, Vauxhall Motors, Ford Motors, Rolls-Royce, Pilkington Brothers, Central Electricity Generating Board, National Coal Board, Air Ministry, The BBC* and *British Railways.*

**For safety, reliability and low maintenance costs, silicone-insulated transformers hold every advantage.**

**MIDLAND SILICONES** supply the silicone resins and elastomers for **Class H and C** transformers. Such transformers are manufactured by the following companies :- *Associated Electrical Industries (Manchester) Ltd · Bonar, Long & Co Ltd · Brentford Transformers Ltd · Brush Electrical Engineering Co Ltd · Crompton Parkinson Ltd · Denis Ferranti Co Ltd · The English Electric Co Ltd · Ferranti Ltd · Foster Transformers Ltd · The General Electric Co Ltd · Gresham Transformers Ltd · Hackbridge & Hewittic Electric Co Ltd London Transformer Products Ltd · C A Parsons & Co Ltd · Bruce Peebles & Co Ltd · South Wales Switchgear Ltd · Transformers (Watford) Ltd · Woden Transformer Co Ltd · The Yorkshire Electric Transformer Co Ltd.*

MS

# Class H for Heinz

Three thousand people at Kitt Green, the new Heinz factory near Wigan, share a brand new building with FOURTEEN Class H transformers.

Smaller and lighter than oil-filled units, these fourteen BRUSH transformers, rated at 500 kVA, three-phase, 50 cycles, 6,000/433 volts, have been installed in a number of sub-stations on the mezzanine floor between the two main production halls. The reason for choosing Class H dry-type transformers is briefly stated by Heinz themselves:

*"These transformers have been selected for reduced fire hazard, particularly with reference to the fact that most of them are installed within the main building. This gives an associated advantage of less complex design of Sub-Station and improved fire insurance arrangements."*

There is no need for special enclosures, nor for special fire-fighting equipment, since Class H transformers are fire and explosion proof. Having transformers *anywhere* in the factory, at load centres, means low-voltage cable runs are very much shorter and floor excavations are rarely needed.

*If you are not already a recipient of our regular news bulletin on the applications of silicones, 'MS News for Industry', please write for a copy.*

MS

**MIDLAND SILICONES LTD** ***first*** *in British Silicones*
*(Associated with Albright & Wilson Ltd and Dow Corning Corporation)*
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*Area Sales Offices: Birmingham, Glasgow, Leeds, London, Manchester.*

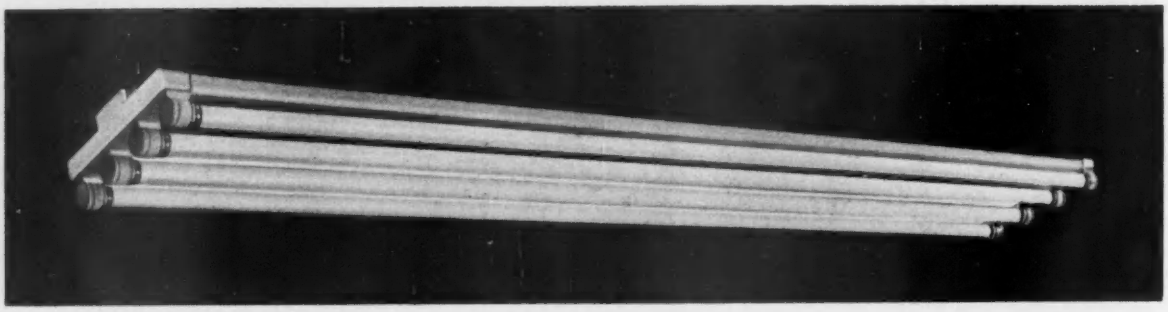
*Agents in many countries*

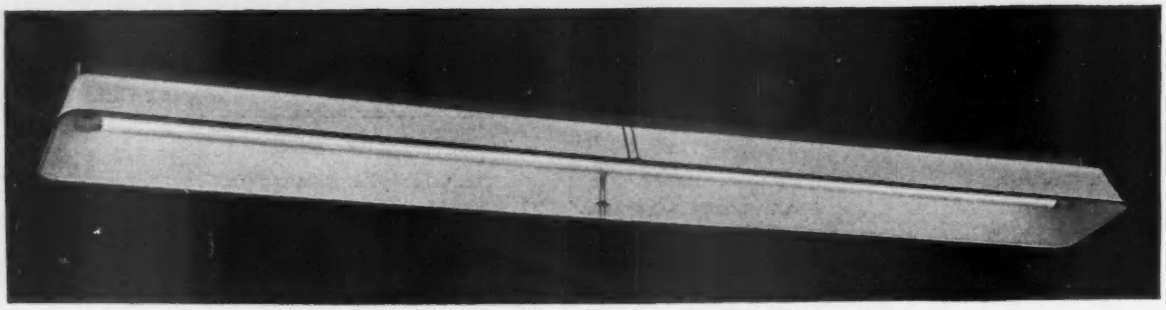
MSE 14

# 2 new fittings for atlas atlantic2 range

One of the trade's top talking points over the last few months has undoubtedly been the Atlas Atlantic 2 range of fluorescent fittings. Now it is given fresh point and impetus with the addition of the two important new fittings shown below.

**NEW 'Double-twin' 4-tube Batten Fitting with the astounding 'Super-8' Circuit**—for stores, supermarkets, etc.





**NEW Two-piece Vitreous Enamel 8 ft. Trough Reflector**—for general factory lighting.

## with all these proven advantages

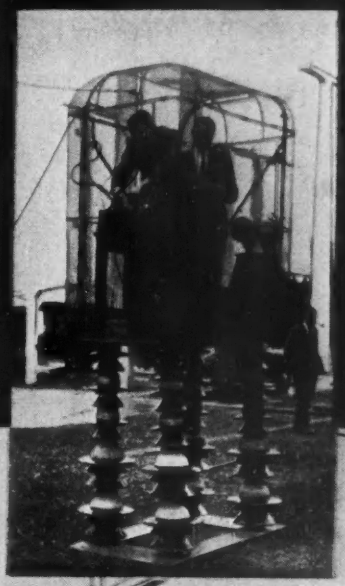
- *Slim, single component spine—pre-wired ready to install*
- *Improved spring-loaded lampholders; need no fixing, no screws*
- *Fast, positive fixing of attachments*
- *Perfect, close-ceiling mounting*
- *Completely closed back, drip and dust-proof*
- *Welded-in screw studs for easy gear fixing*
- *Snap-fit terminal blocks*
- *Rugged, cast end-plates*
- *Enclosed through-wiring channel*
- *'Miracryl'—the outstanding new finish*

atlas FLUORESCENT LIGHTING FOR ALL

ATLAS LIGHTING LIMITED · THORN HOUSE · UPPER ST. MARTIN'S LANE · LONDON W.C.2

DTV

# *in advance of demand*



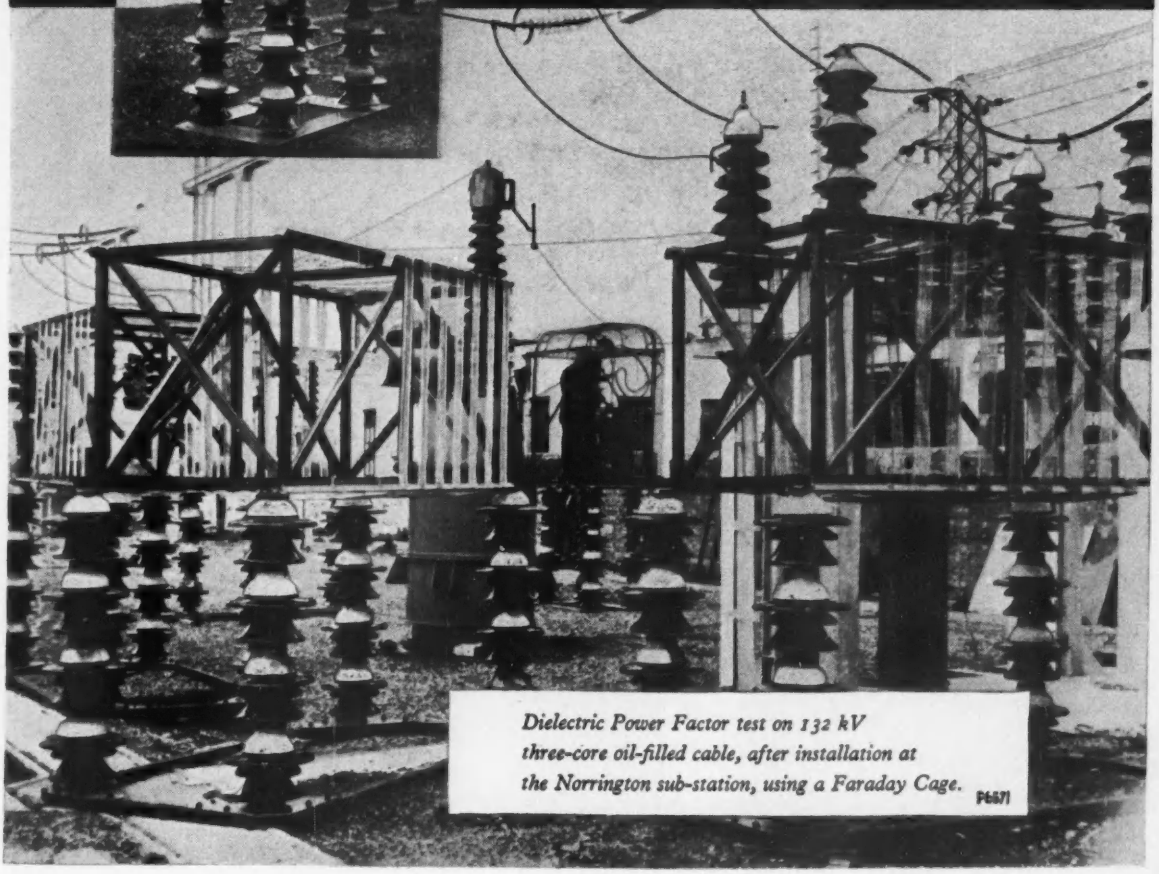
132 kV three-core oil-filled cables were supplied to the Central Electricity Generating Board, Southern Division.

These cables are operating at a maximum stress of 125 kV cm. the highest ever known for 132 kV cables. This results in a reduction of capital cost.

The prototype cable and accessories have been subjected in the Pirelli-General laboratories to type approval and development tests far in excess of the C.E.G.B. requirements, both at normal operating temperature and elevated temperatures—another instance of an outstanding development by this compact Company.

PIRELLI GENERAL

PIRELLI-GENERAL CABLE WORKS LIMITED, SOUTHAMPTON & EASTLEIGH

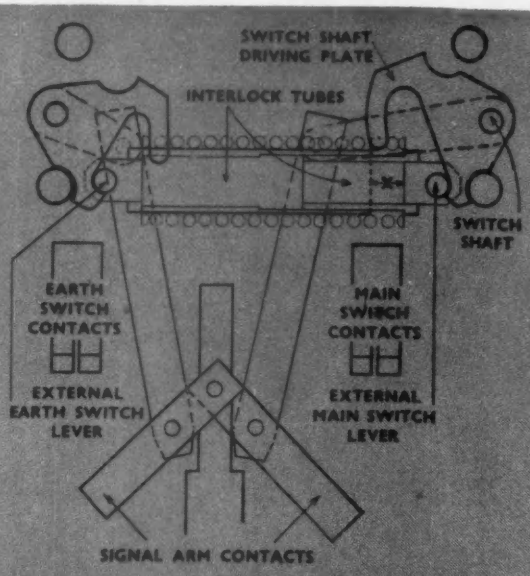


*Dielectric Power Factor test on 132 kV three-core oil-filled cable, after installation at the Norrington sub-station, using a Faraday Cage.* P6571

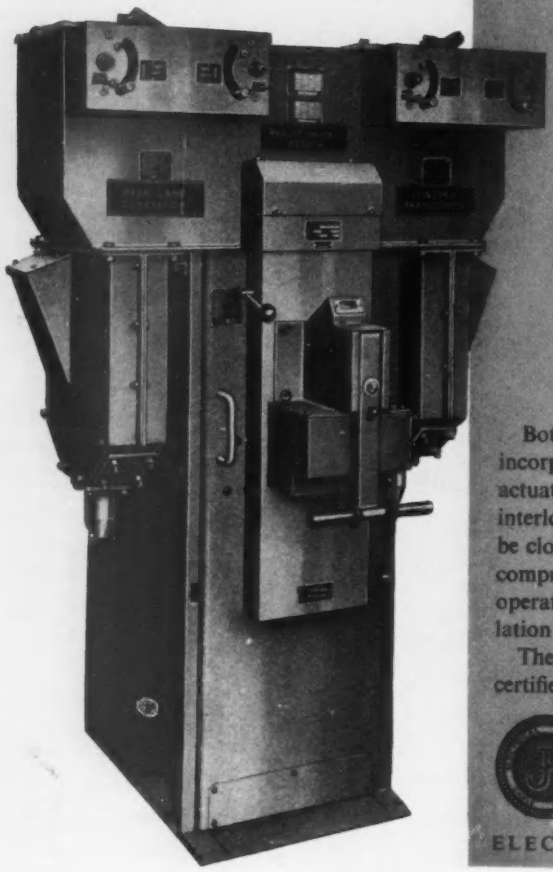
**J. & P.** *lead the field*

# OVER 600 UNITS WITH MANUAL SPRING-OPERATED MECHANISMS

**have been supplied or ordered**




**J. & P.**



## TYPE NX RING MAIN UNITS AND TYPE SX OIL SWITCHES

**for 6.6 kV systems up to 250 MVA and 11 kV systems up to 350 MVA**

Both the Type NX ring main unit and the Type SX oil switch incorporate mechanisms with separate main and earth switches actuated by a common spring arranged to provide an integral interlock. This ensures that the main and earth switches cannot be closed at the same time. Operation of the switch, after initial compression of the spring, is entirely independent of the operator's speed and the hazards arising from hesitant manipulation are completely eliminated.

These mechanisms were incorporated in units, tested and certified to B.S.2631: 1955 at K.E.M.A. as far back as 1958.

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ELECTRICAL ENGINEERS AND CABLE MAKERS

## *If yours is "no ordinary" lighting problem*

Well, we don't talk about "Lighting problems" ourselves, because a project is no longer a problem when you know the answer. But industrial lighting does often call for expert knowledge and experience, a particular knotty point may be similar to a job we tackled last week, or even if it is a new one the distillation of knowledge gained from experience of other challenges will enable us to advise you correctly.

Just a few fittings in the wide range of Simplex Lighting Equipment are shown here.

But we don't want just to sell you lighting fittings. We want to sell you light. The right amount of light in the right place at the right time. Therefore, we would be pleased to help or offer advice on any of your lighting problems — the type of fittings to use, the installation layout for best results etc. without obligation.

For immediate service there's a local Simplex branch near at hand — or write to Lighting Dept., at the head office address below.

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PRODUCE LIGHTING
TAILORED TO
EVERY
REQUIREMENT
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YOURS

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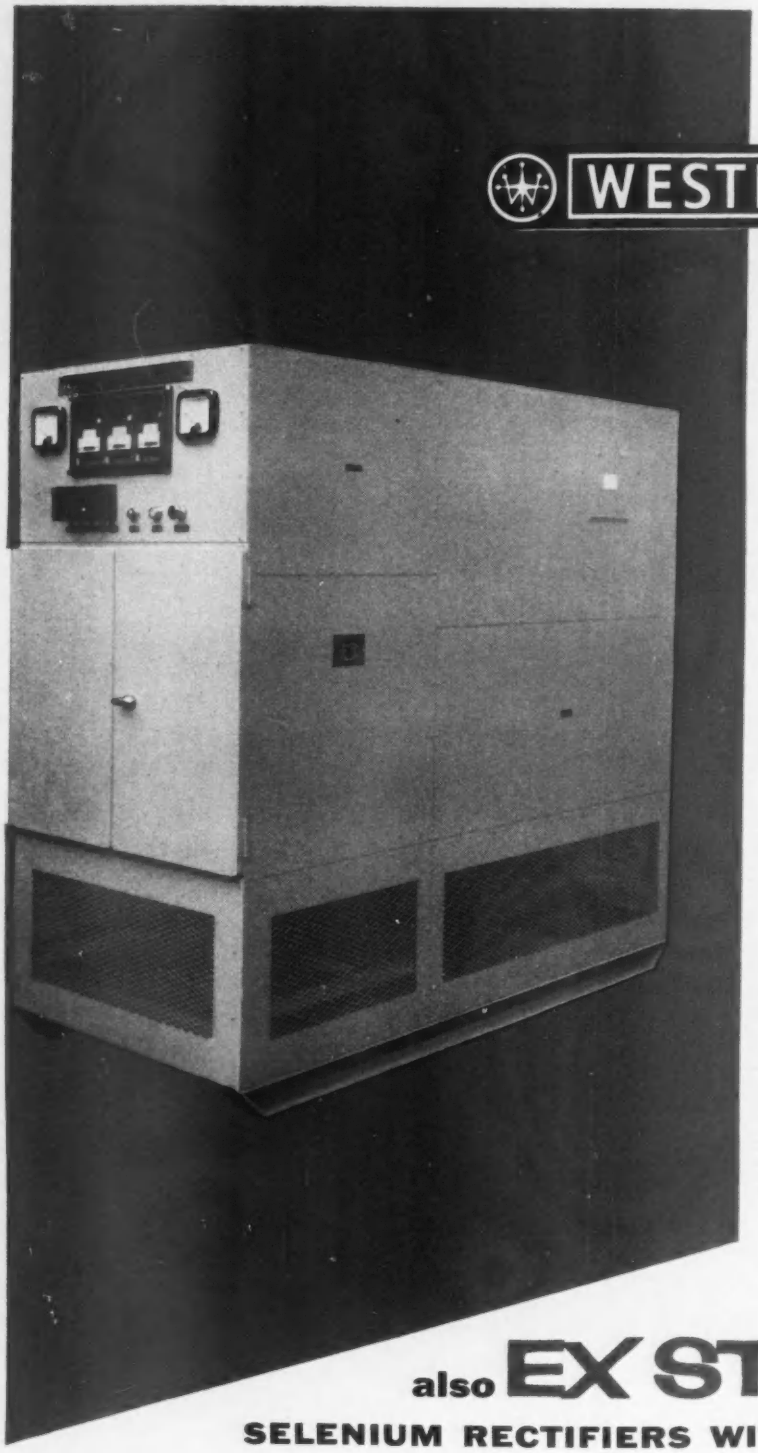
ELECTRICAL DIVISION *Detailed literature available on request*

L.10



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## 20 to 500 kW d.c. for general industrial service

- A complete range of 200/250 and 400/500 volt rectifier equipments are fully described in Engineering Publication 837/1.
- Short delivery requirements for d.c. supplies of from 20 to 120 kW at 400/500 volts can now be met from stock production.
- Westinghouse also invite your enquiries for silicon rectifier equipment complete with transformers for large power requirements exceeding 500 kW d.c. at medium voltages.

## also EX STOCK

### SELENIUM RECTIFIERS WITH TRANSFORMERS

with d.c. outputs from 50 watts to 10 kW in the popular voltage ranges 100/120, 200/250 and 400/500 volts for single—or three-phase operation are readily supplied.

For full details please write to Dept. ET 11/61, Rectifier Division, Industrial Equipment.

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# Telcon Bimetal for temperature indication

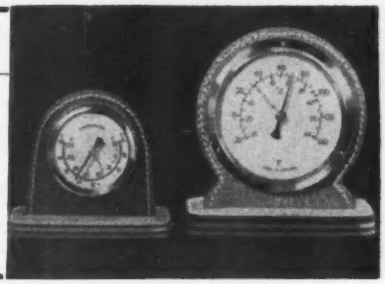
Telcon Bimetals are widely employed in many types of thermometers, typical examples of which are manufactured by Regwell Limited and illustrated below.

Thermostatic Bimetals consist of two alloys bonded together at their interface and having different coefficients of linear expansion. When subjected to temperature change, the strips will deflect or spirals will rotate to give an indication of temperature.

Bimetal elements are ideal for use in the manufacture of thermometers, control elements for air conditioners, ventilators, water mixers, valves, driers, ovens, domestic irons, immersion heaters, radiators, thermostats, fire alarms etc.

Table giving the properties of the more important types of Telcon Thermostatic Bimetals.

| Type | Strip* Deflection Constant | Electrical resistivity Microhm-cm at 20°C | Range of max. Sensitivity °C | Useful deflection Range °C | Stabilising Heat Treatment Temp, °C for one hour |
|---|---|---|---|---|---|
| 140 | 14.0 x 10-6 | 76 | 20-200 | -70 to 350 | 350 |
| 400 | 12.0 x 10-6 | 70 | 70-300 | -70 to 400 | 350 |
| 15 | 9.5 x 10-6 | 17 | 20-120 | -70 to 220 | 350 |
| 75 | 6.8 x 10-6 | 57 | 150-300 | -70 to 500 | 350 |
| 38 | 3.8 x 10-6 | 56 | 20-250 | -70 to 500 | 350 |
| 188 | 9.0 x 10-6 | 93 | 10-150 | -70 to 500 | 350 |
| 131 | 13.3 x 10-6 | 18 | 10-120 | -75 to 150 | 175 |
| 11 | 8.4 x 10-6 | 20 | 10-150 | -70 to 350 | 350 |
| 200 | 19.9 x 10-6 | 109 | 10-175 | -75 to 160 | 260 |



*The deflection constant (d) is defined as the deflection of a strip of unit length and unit thickness for each °C rise in temperature over the linear part of the deflection curve.

All types of Bimetal shown in the table are manufactured in strip form down to 0.005 in. thick, in widths not greater than 6 in. They can also be supplied down to 0.0025 in. thick with a maximum strip width of 3 in. Cut strips are also supplied. Materials can be suitably etched to indicate the high or low expansion sides, as requested.

*enquiries to:* **TELCON METALS LTD.**

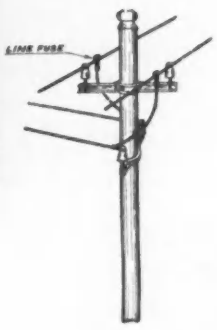
MANOR ROYAL · CRAWLEY · SUSSEX · Telephone: Crawley 1560 · Telex 8748 · Telegrams: Telcon, Crawley, Telex.

*A MEMBER OF THE* BICC *GROUP OF COMPANIES*

# LINE FUSE CONNECTORS FOR OVERHEAD SERVICES

FUSE CONNECTOR

No. LF 176 Up to 20 amps
No. LF 211 „ 60 amps
No. LF 222 „ 100 amps
No. LF 233 „ 200 amps




This connector increases reliability, because service mains, etc., are fused where connected to main conductors, thus any fault leaves the main conductors unaffected.

SIMPLE IN DESIGN

EASILY ERECTED

***Thousands in use at home and abroad***

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Greenings RF6 Cable Tray System has been designed to give maximum rigidity for heavy cable installation. The inverted 'U' section edges, wider spacing of perforations and heavier than average gauges of metal make the trays exceptionally strong. The 8′ mild steel sections can be fixed easily and quickly with the robust coupling pieces which give continuity of strength. Write for full details.

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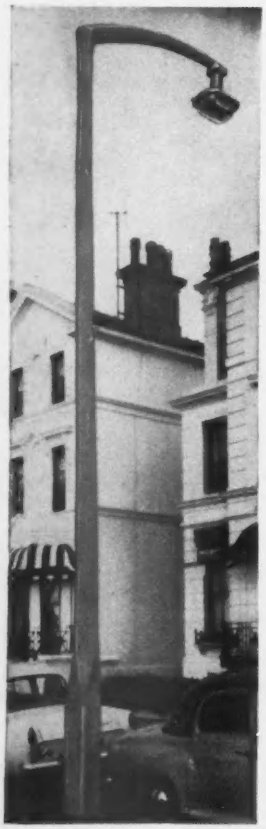


## Recent developments in L.E.F. RAISING AND LOWERING GEAR for concrete and steel columns

**CONCRETE COLUMNS:**

Messrs. Concrete Utilities Limited have produced a special bracket arm to which the working parts only of the Contact Suspension Unit may be fitted direct and in which there are two steel tubes, one for the electric cables and one for the winch rope. A pulley, and a cover for the working parts, are also supplied with this bracket arm. The advantages of this arrangement are simplification of installation, ease of operation and reduction in cost.

**STEEL COLUMNS:**

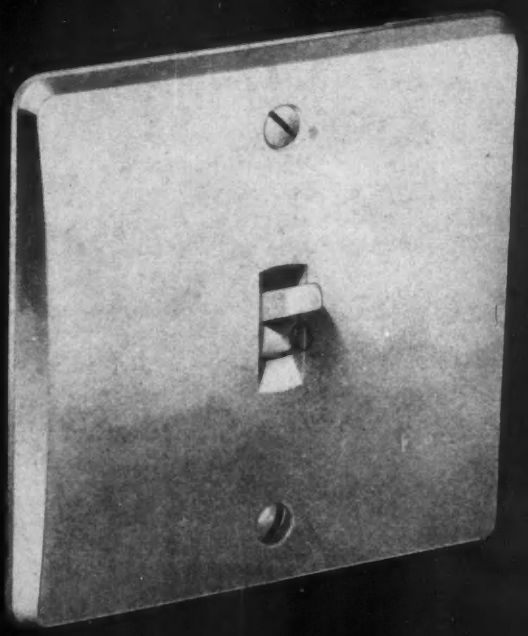
A new Contact Suspension Unit with four contacts has been designed for use with lanterns such as the GEC lantern using Osram 280 watt integral sodium lamps for 35 ft mounting heights. Messrs. Stewarts and Lloyds Limited co-operated with the design of the bracket arm of their column and with arrangements for fitting a pulley to the top of the column at their works before despatch. Here again, simplification of installation and ease of operation have been achieved.

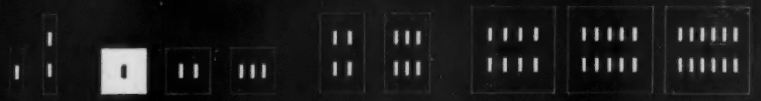
*L.E.F. Raising and Lowering Gear, acknowledged the quickest and most convenient means of servicing out-of-reach lights, enables one man operating from ground level to carry out maintenance, thus making considerable savings in time, labour and vehicles.*

*Working models of L.E.F. Gear in street lighting columns can be seen at our Croydon works and an advisory service is ready at all times to assist you with light maintenance problems.*

L&F
**LONDON ELECTRIC FIRM LTD.**
**Brighton Road, South Croydon, Surrey.**
Telephone: Uplands 4871

# the switch that is silent...





# that's the New Approach of G.E.C.

## 'MUTAC CLIPPER'

G.E.C. Installation Equipment Group have a *new approach* to switch design which serves to take the clicking out of switching.

If you listen hard enough you *may* just hear the discreet whisper of a 'Mutac Clipper'.

Furthermore, the *new approach* makes 'Mutac Clipper' switches unrivalled for ease and speed of assembly . . . ensures that these precision-made, electronically-tested switches give a guaranteed long-life performance.

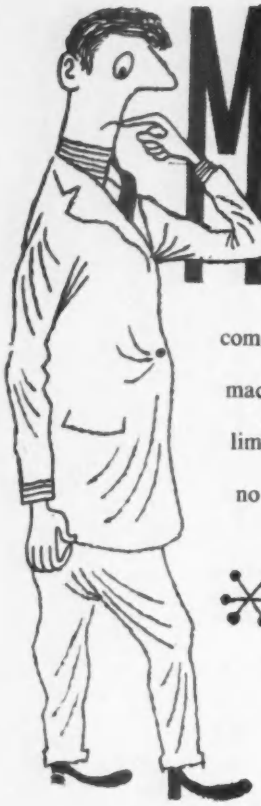
G.E.C.'s *new approach* enables you to put one, two or three 'Mutac Clipper' switches in a standard BS1299 box. There's a choice of 44 different switch plates—in moulded plastic or metal—and 11 interchangeable units fit into just three different sized boxes:

5 amp 1 way S.P.
15 amp 1 way S.P.
5 amp 1 way D.P.
5 amp 2 way S.P.
5 amp 2 way & off
5 amp intermediate
5 amp 1 way secret
5 amp 2 way secret
Bell Push
Neon Indicator
Blanking Unit

'Mutac Clipper' switches cost no more than ordinary switches to buy and far less to install—that's a result of G.E.C.'s *new approach.* Complete interchangeability of 'Mutac Clipper' enables you to standardise right through a job.

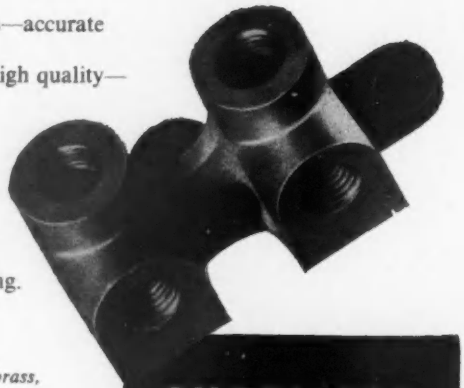
**INSTALLATION EQUIPMENT GROUP**

***IMMEDIATE DELIVERY** of all 'Mutac Clipper' switches from wholesalers throughout the country. If you would like more detailed information, ask your wholesaler for 'Mutac Clipper' literature.*



# May we do your pressing?

For hot pressings and stampings—accurate well-finished and of consistently high quality—come to Sutcliffe Speakman. We undertake machining where necessary and can work to limits down to ·0005". No quantity is too large, no job too complicated, no standard too exacting.



*In all non-ferrous alloys including aluminium, brass, chromium copper, cadmium copper, manganese bronze and nickel silver. Also castings in gun-metal, phosphor bronze and heat-resisting nickel chrome alloys.*

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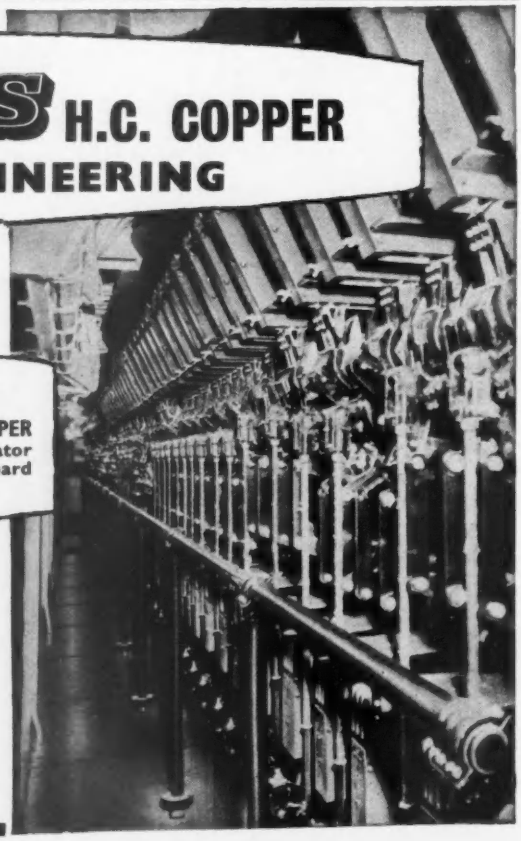
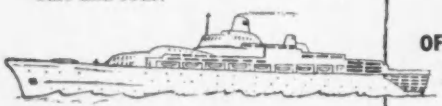
# BOLTON'S H.C. COPPER IN MARINE ENGINEERING



For the rapidly expanding world of marine electrics Bolton's manufacture commutator bars and segments in h.c. copper and "combarloy" (a silver-bearing copper); extruded and drawn sections; annealed strip for alternator windings ; busbars; bars and rods.



**21 TONS**
**OF BOLTON'S H.C. COPPER**
**used on main generator and feeder switchboard in s.s. "Oriana"**

*s.s. "Oriana", 42,000 tons gross, the latest addition to the P & O—Orient Lines fleet built by Vickers-Armstrongs (Shipbuilders) Ltd.*

The photograph on the right shows the rear view of the feeder section of the main switchboard, 69′ in length, manufactured by **Whipp & Bourne Ltd.** For this section and also the generator section, Bolton's supplied 21 tons of h.c. copper.

*Photograph by kind permission of Vickers-Armstrongs (Shipbuilders) Ltd.*

THOMAS BOLTON & SONS LTD
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CVB 377

# Thermostatic Bimetal by—

# B·D·H

*Thermostatic bimetal is an extremely complex material. It embodies — in different degrees, depending on composition and manufacture — such properties as temperature sensitivity, deflection rates, torque, resistivity and corrosion resistance. Because no one of these follows inevitably from any other, we as manufacturers have quite a handful to cope with.*

The user, too, has *his* problems. It can be quite an exercise arriving at the type of thermostatic bimetal which combines, in the right proportions, all the characteristics necessary to do a particular job effectively. That is where we can help. First, with a very useful general Data Sheet. Secondly, with technical advice on specific applications. Thirdly, with small orders for prototype purposes.

So often, the difference between a bimetal problem and its solution is a word with the experts. Throwing modesty to the winds, that means us!

**Type 2400.** Excellent general purpose bimetal. Maximum sensitivity range 0°F to 300°F, with high torque and deflection in the useful range − 100°F to +700°F. Can withstand 800°F.

**Type 3600.** Ideal for appliance thermostats. Maximum sensitivity range 0°F to 600°F. High deflection and good strength properties in the range of maximum sensitivity. Can be used up to 900°F.

**Type 4700.** Particularly suitable for compensator applications. Maximum sensitivity range 0°F to 300°F. Medium deflection rate. For use up to 800°F.

**Type 4800.** Particularly suitable for compensator applications. Maximum sensitivity range 0°F to 400°F. Low deflection rate. For use up to 700°F.

**Type 6650.** For low temperature thermostats and low ampere circuit breakers. Exceptionally sensitive in the 0°F to 400°F range. Not for use above 400°F, or in corrosive conditions.

**Type 6850.** High resistivity distinguishes this circuit breaker bimetal. Not recommended for use above 400°F, or where corrosive conditions exist.

NICHROME

**BRITISH DRIVER-HARRIS CO LTD**

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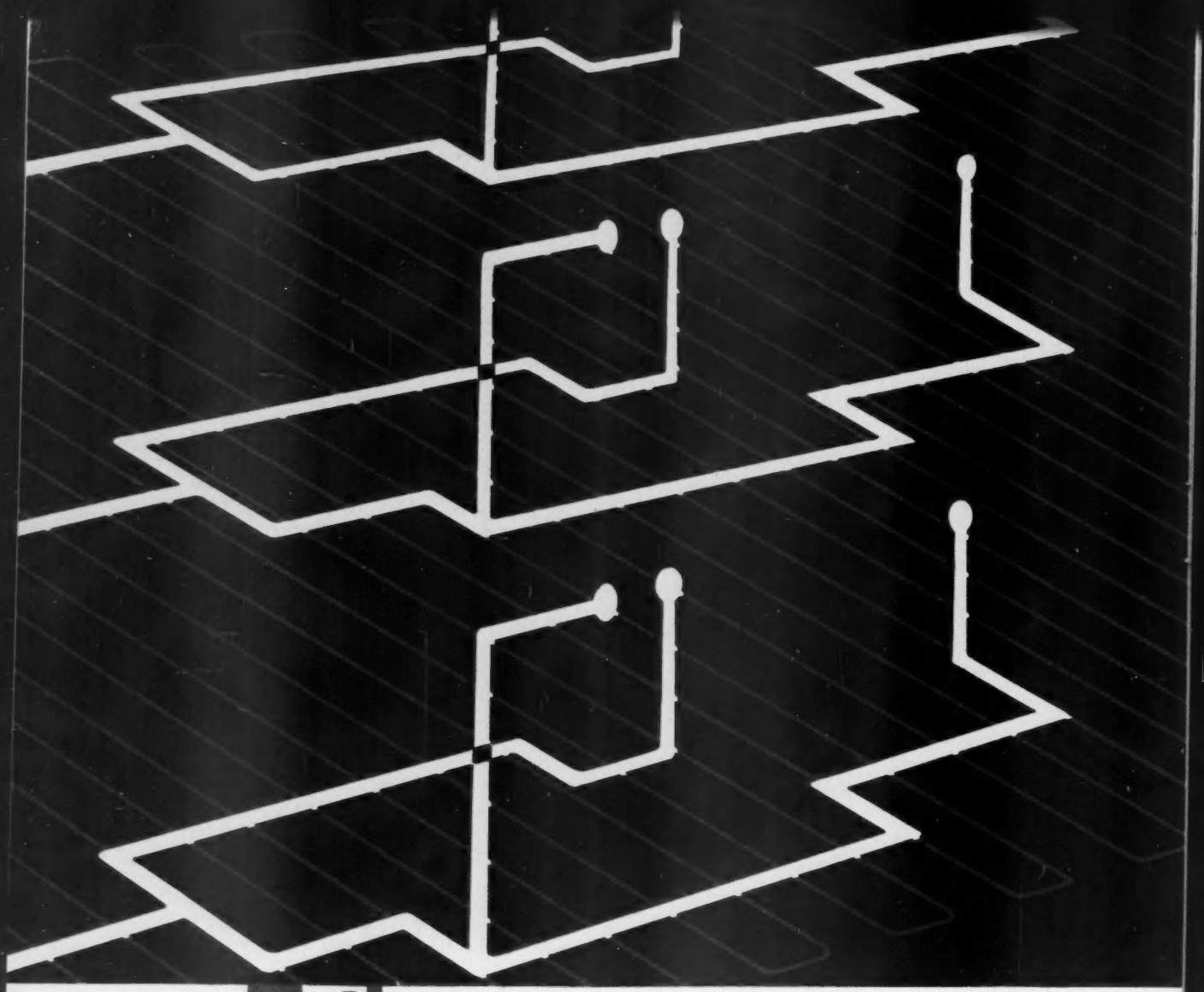
*If you want comprehensive details of our versatile range of bimetals, Data Sheet No. 4 is the very thing.*



# Tailor made to cut costs

on all electrical services

Wherever repetitive cable runs are required "Pyrotenax" P.C.U's show dramatic savings in time, labour and materials. P.C.U's–pre-assembled cable units–are cables cut to customers specified lengths. They are factory assembled with seals and terminations, according to requirements. All units are fully tested before despatch, and coded for identification. Installation is simply a matter of clipping into position and connecting up.

Apart from their outstanding economy and simplicity, P.C.U's possess all the established characteristics of "Pyrotenax" cable.

**Pyrotenax**
REGD TRADE NAME

*The use of the trade name "Pyrotenax" is exclusive to the products of this Company and its associates.*

## P.C.U's (pre-assembled cable units)

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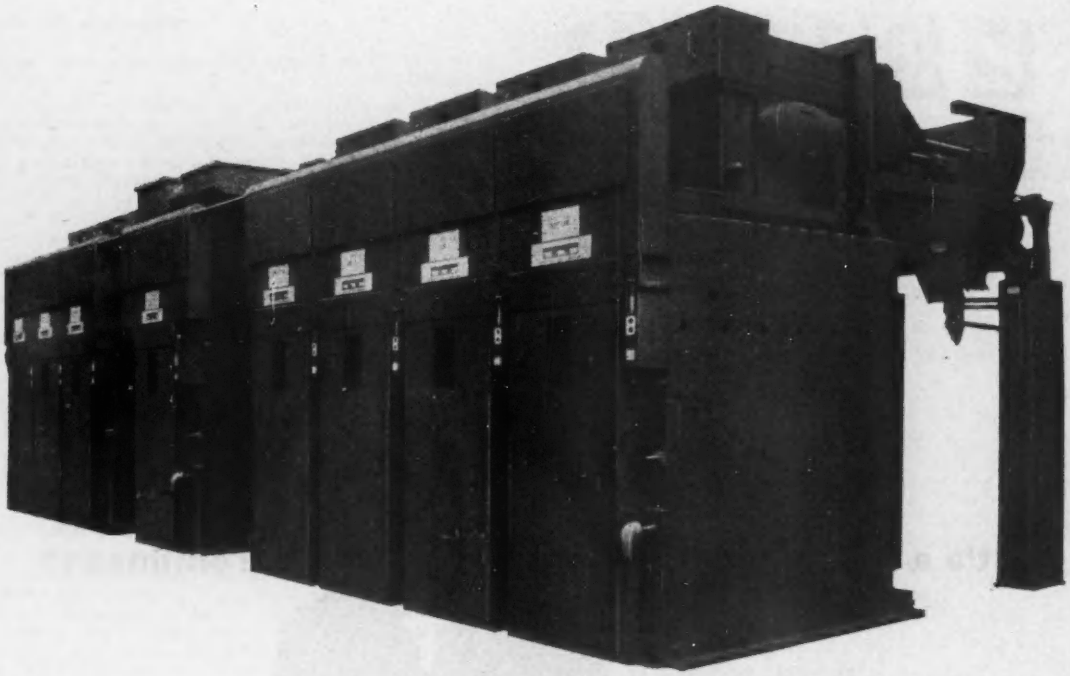
GD 788



# Types L42T and L45T switchgear

This vertically-isolated metalclad switchgear incorporates many novel and desirable features and fulfils a demand for an easily-manœuvrable circuit-breaker occupying a minimum of floor space.

Ask for pamphlet No. 1273

**Ratings:**

1000 MVA at 22 kV
1500 MVA at 33 kV

Type L42T: 1200 A
1600 A

Type L45T: 2000 A

Busbars up to 2000 A

**Reyrolle**

A. REYROLLE & CO. LTD. · HEBBURN · COUNTY DURHAM · ENGLAND

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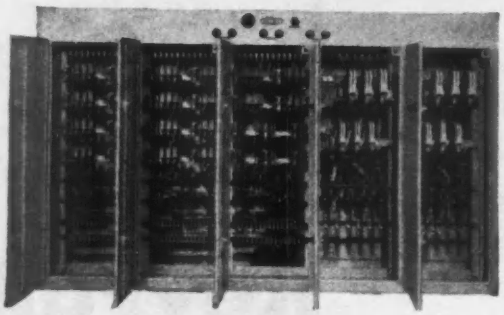
"It's a very hush-hush job, Mr. Tomlinson"



*G.W.B. Resistance Furnace AC Contactor Panel including auxiliary motor equipment*

A word leaking out in the wrong direction could upset years of work of design engineers. For a panel like this could double the output of canned soup, or increase foundry productivity. It could even be increasing the turnover of one of your competitors.

In paint, in steel, in plastics, in rubber . . . in virtually every industry . . . G.W.B. control boards are being put to constant use to improve production methods — increase productivity, speed output. Leading industries call in G.W.B. for advice. You could too.

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GWB/283

THURSDAY 23 NOVEMBER, 1961
Registered as a Newspaper Volume 140 No. 21

# ELECTRICAL TIMES

SARDINIA HOUSE, SARDINIA STREET, LONDON, W.C.2
Telegrams: Equivolt . Estrand Telephone: HOLborn 6016

## *Dans ce numéro*

**Stockage stérile avec usage de lampes à rayons ultraviolets** ... ... ... ... ... ... 759

Les radiations ultraviolettes sont un moyen efficace de tuer les micro-organismes. Une étude a été effectuée sur l'application de ces rayons dans un appareil semi-portatif conçu pour donner une enceinte stérile. On se sert d'un tube à rayons ultraviolets de 15kW, alimenté par une batterie de 12V ou 24V par l'intermédiaire d'un convertisseur transistorisé. L'on a démontré qu'avec cet appareil il est possible de maintenir une atmosphère stérile dans une salle de stockage, et qu'il suffit d'une période de temps relativement courte pour désinfecter des surfaces très contaminées d'une forme non compliquée.

**Four de faible masse thermique** ... ... ... 762

On se sert de réchauffeurs électriques tubulaires dans un four en forme de cloche à plonger pour l'élimination des tensions dans les grandes constructions en acier soudé. Les éléments fonctionnent sur 440V et ont une puissance de 13kW par mètre de longueur. Ces fours permettent de traiter à la chaleur des constructions telles que les chaudières dans l'usine même où elles sont fabriquées. Le détartrage de l'acier est presque éliminé.

**Etude de boîtes à bornes pour les moteurs** ... ... 766

A la suite d'ennuis causés par des explosions on a procédé à de nouvelles études relatives aux boîtes à bornes des moteurs haute tension. Il s'est avéré souhaitable de se servir d'acier plutôt que de fonte, afin de réaliser la résistance nécessaire pour supporter les pressions qui se produisent à la suite d'un défaut dans une boîte. Des prises d'air sont prévues pour l'élimination des pressions: ces prises d'air sont scellées par des bouchons en caoutchouc ou des diaphragmes en film d'acétate cellulosique. Les boîtes sont dotées de joints pour réduire l'entrée d'eau.

## *In dieser Nummer*

**Sterile Aufbewahrung mit UV-Lampen** ... ... 759

UV-Strahlung ist imstande, Mikro-Organismen abzutöten. Die Möglichkeiten der Anwendung dieser Strahlung in einem beweglichen Apparat, der einen sterilen, geschlossenen Behälter abgeben soll, sind untersucht worden. Dabei wurde eine 15W UV-Röhre eingesetzt, die über einen transistorisierten Wechselrichter von einer 12V oder 24V Batterie gespeist wurde. Das Ergebnis war, dass sich auf diesem Wege eine sterile Atmosphäre in einer Aufbewahrungskammer sehr wohl aufrechterhalten lässt und dass stark verunreinigte Oberflächen einfacher Formgebung verhältnismässig schnell desinfiziert werden können.

**Wärmeofen mit geringer Wärmekapazität** ... ... 762

Zur Entspannung grosser Stahlgebilde werden in der Fertigung rohrförmige Heizer in einem Ofen eingesetzt, der die Form einer Taucherglocke hat. Diese Elemente arbeiten mit einer Spannung von 440V und sind für eine Leistung von 13kW pro Meter Heizleiter ausgelegt. Ofen dieser Art ermöglichen z.B. die Wärmebehandlung von Kesseln im Fertigungswerk. Dabei wird die Verzunderung des Stahls beinahe vollkommen vermieden.

**Konstruktion von Klemmenkästen für Motore** ... 766

Im Hinblick auf durch Explosionen verursachte Störungen wurden neue Konstruktionen für die Klemmenkästen von Hochspannungsmotoren entwickelt. Die Verwendung von Stahl anstatt Gusseisen stellte sich als wünschenswert heraus, und zwar um eine Festigkeit zu erzielen, die dem Druck standhalten kann, der bei Entstehung eines Fehlers im Kasten aufgrund der Lichtbogenbildung erzeugt wird. Es werden Druckminderungsöffnungen vorgesehen, die mittels Gummipfropfen oder Häutchen aus Zelluloseazetatfilm abgedichtet werden. Die Kästen werden mit Dichtungen versehen um das Eindringen von Wasser auf ein Minimum zu beschränken.

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**Low Thermal Mass Furnace** ... ... ... ... 762
*by R. M. Glashen,* M.B.E., C.G.I.A., M.I.E.E., A.M.I.MECH.E.

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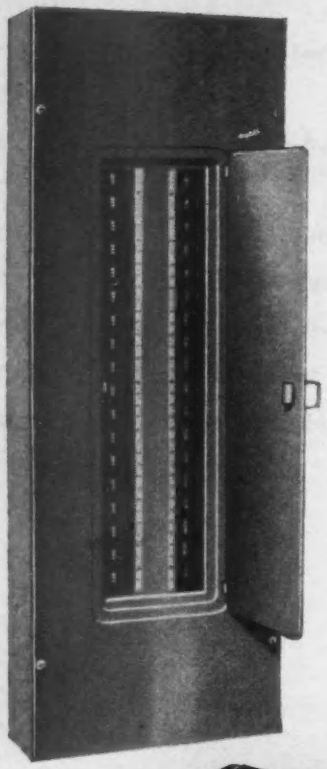

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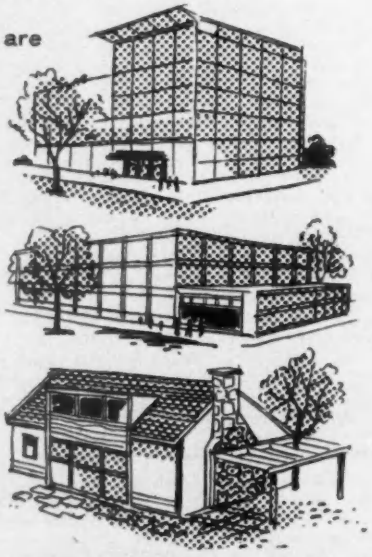

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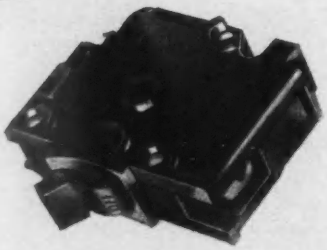

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# Comment

## FUEL FUTURE

Sir Christopher Hinton's lecture last week to the Stoke-on-Trent Engineering Society provides a useful round-up, if no more, of current predictions on the future of electricity generation. Particularly valuable is his up-to-date estimate of the fuel situation. This is based on the assumption that the maximum amount of coal available, or ever likely to be available, from the NCB for CEGB power stations will be 100 million tons a year. In ten years' time total fuel requirements in coal-equivalent terms is put at 130 million tons/year. On oil, Sir Christopher takes the stand that the supply industry should be allowed to use all the residual fuel oil it can get from the output of British refineries, but he implies that the use of imported fuel oil is to be ruled out. It will be of interest to see how this thinking is affected if closer integration with Europe comes through Common Market developments. Recent comments by the Minister of Power, indeed, have indicated that Common Market prospects ought to be kept in mind as well when considering coal calculations. But whatever way that question is looked at, the necessity for a nuclear contribution in ten years' time seems clear. In that field, the interest of Sir Christopher's lecture lies in his admission of concern about the rate of advance that is being forced. As the time for commissioning of the first CEGB nuclear stations draws near, there is a warning that the extension in size of planned nuclear stations before even one is working represents "a rate of extrapolation of experience far greater than is welcome to responsible engineers." If, however, as all must hope, the extension of experience proves successful, then the natural uranium reactor of the Calder Hall type may expect to continue to cut costs. In consequence, there seems increasing doubt about a place for the advanced gas-cooled reactor.

## TERMINAL TROUBLES

CEGB and BEAMA co-operation has evolved a new design of terminal box for h.v. motors. Announcement of details of the design to a lively IEE meeting last week marks what must be hoped to be the final stage in a quite remarkable episode of minor electrical engineering history. Failure of terminal boxes on h.v. motors in power stations began suddenly to be discussed about four years ago, with particular attention to the explosive nature of some of the failures. Cast iron boxes fragmented under internal pressures generated by arcing faults. Subsequently, investigation showed that there had been some 74 faults out of about 3,600 motors at risk in the five years up to January, 1958, and that about half of the incidents had been explosive, with fragments thrown many feet away from the

motor. Faults originating in the terminal boxes had caused some of the trouble; faults in the motor winding had been responsible on other occasions, the terminal arrangements being too weak mechanically to stay electrically sound under the strong electromechanical forces generated by the through-fault current. Why this should happen so frequently to a detailed item of equipment which had given little trouble before is still untraced to any single cause. High prospective fault current in power station auxiliary circuits is a factor; so may be switching surges. Poor workmanship plays a part as well. Many views exist on these points, but common ground has been reached on the action to be taken. It is to have terminal boxes first of all inherently unlikely to fail in a way that produces internal arcing; this was a point that seemed insufficiently appreciated in the discussion last week. Having done all that is possible in that direction, the design has to provide that if there is arcing, then there shall be no explosion, no pieces of metal flying about. This has been secured at the expense of a risk of flame and smoke being projected many feet through pressure relief vents—hardly a happy prospect.

## USSR ACCELERATES POWER EXPANSION

There was much electricity supply information as well as political theory in the massive speeches of Mr Khrushchev to the USSR Communist party congress last month. This has become apparent from the full translation of the speeches now available in this country. Most impressive is the rate of expansion of generation which is at the heart of the declared programme. Not doubling every ten years, but a trebling is to be provided for. From an estimated USSR output of 300,000 million kWh last year, the output is due to be expanded to 3,000,000 million kWh by 1980. What this means in terms of power stations is only outlined in the programme, but the overall pattern seems settled. Massive development of hydro-electric potential is to be at the heart of the plan. Eastern Siberia has at least six new stations scheduled, each of 4,000 MW capacity. Further large hydro stations are to form part of power-irrigation projects. But if the emphasis is on hydro, that does not mean that steam stations are neglected, nor that they are on an appreciably smaller scale. Specific mention is made, for example, of "200 local power stations of up to 3,000 MW each" to be built in the next 20 years. What is missing from the programme is any sign of expectation that nuclear generation is to play a significant part in the country's power plans. On the other hand, the interest that has long been apparent in combined district heating and power generation is expected to blossom in "260 big heat-and-power stations." These are indeed remarkable plans, and progress with them will be watched closely from the West. They are launched with an enthusiasm for the importance of electrification in advancement that may even cause a pang of wistful envy here—for the recounting of them led Mr Khrushchev to exclaim: "What grand, truly breath-taking plans, comrades! The sun of Communism is indeed rising over our land!" And there is not a word about lines desecrating the countryside.

## HEATING FLEXIBILITY

The need to sell the flexibility that electricity can offer has been stressed many times in these columns. The lesson is pointed sharply in the story we publish this week of the South of Scotland EB's development of a low-thermal-mass furnace. This is a heating unit which is simple enough technically, yet which illustrates well how electricity can often sell on its incidental advantages. Simple resistance heating is involved. Because the flexibility of electricity permits taking the heat to the point where a structure is fabricated instead of moving the structure to the furnace, economy becomes possible. When the further economy of heating-up little more than the structure is added, without intermittent heating of massive conventional furnace walls, the advantages become compulsive.

## DELIVERY DETAILS

The one-day conference on exporting, which was last week organised by the British Productivity Council, inevitably covered much familiar ground. It justified itself by bringing some hard talking and probing criticism from men operating in contact with overseas customers. Amongst the complaints, there stood out once more concern about deliveries. It is not only the long gap between the placing of the order and the promised date of receiving the goods that is troublesome. Worse in its effect can be failure to meet quoted delivery promises, and a casual attitude to such failures. There is an air of inevitability about this and a tendency for manufacturers to go on to the defensive whenever the subject is raised. Certainly, they have much to contend with; labour troubles and labour shortages spring at once to mind. Yet such difficulties are only part of the picture. Although the principal aim should be to cut down delivery times, until that can be achieved attention should be given to moderating the incidental bad effects on customer opinion. At all levels of industry, the question of delivery and order progressing seems a suitable subject for office automation and method research. This follows since each order received by a firm, or even by some competitor using the same raw materials suppliers, can alter the practicable delivery. The effect of the changing order book on delays has got to be estimated more quickly and more accurately than at present. The results of such estimates need to be flashed quickly to all concerned—and the customer is very much concerned. Even early delivery can be an embarrassment if it comes without warning—and no good advertisement for general efficiency if an apologetic three months has been offered a fortnight earlier.

Meteor

*This week's quick summary of electrical news faces advertisement page 16*

# Ultra-violet sterile storage

## APPLICATION TO SEMI-PORTABLE EQUIPMENT

by D. H. Holloway*

GENERAL principles affecting the application of short wavelength ultra-violet radiation to the field of general industrial and medical hygiene were the subject of a previous article in this journal. Briefly, the source of radiation—a so-called germicidal tube—is similar in dimensions and electrical characteristics to a fluorescent lamp, utilising the principle of an electric discharge through mercury vapour at low pressure. Providing the envelope is of quartz or a special UV transmitting glass, such a discharge emits a very high percentage of the input power in the form of radiation at a wavelength of 2,537 A.U. This wavelength being close to that having an optimum inactivating effect on bacteria.

Data on these tubes is given in Table 1, and a spectral distribution diagram is shown in Fig. 1, together with a superimposed curve of the inactivating efficiency expressed as a percentage related to wavelength.

**Table 1 shows lamp data**

| Lamp data | | 15 W tube | 30 W tube |
|---|---|---|---|
| Lamp voltage | V | 53 | 100 |
| Lamp current | A | 0·33 | 0·37 |
| Life | hr | 2,500 | 2,500 |
| Radiant output at 2,537Å (100 hr figure) | W | 3·5 | 8·0 |
| Diameter | in. | 1 | 1 |
| Nominal length | in. | 18 | 36 |

The effect of ultra-violet radiation on micro-organisms has been the subject of considerable research and, in general, it is apparent that judicious use of such radiation provides a means of protection against bacterial infection in a number of situations of medical and industrial importance. Whilst there is no doubt regarding the efficacy of such radiation when applied under controlled conditions, major problems arise when techniques to be employed in practical use are under consideration. This is particularly so when apparatus embodying such a source of radiation is used by persons unfamiliar with the equipment or the principles involved.

An instance is the employment of an ultra-violet tube in a semi-portable apparatus designed to provide a sterile enclosure. Such an apparatus being of potential use in hospitals, pharmaceutical laboratories; in fact, in any situation where materials are required to be preserved in a sterile condition. The ultra-violet tube is a considerable advance on current techniques in this respect as it merely requires an electrical supply to be ready for use within 1 min or 2 min of switching on. No high temperatures, steam, or liquid sterilising agents are necessary, the particular effects of which limits the type of materials which can be used in such apparatus.

* Philips Electrical Ltd., Lamp and Lighting Group.

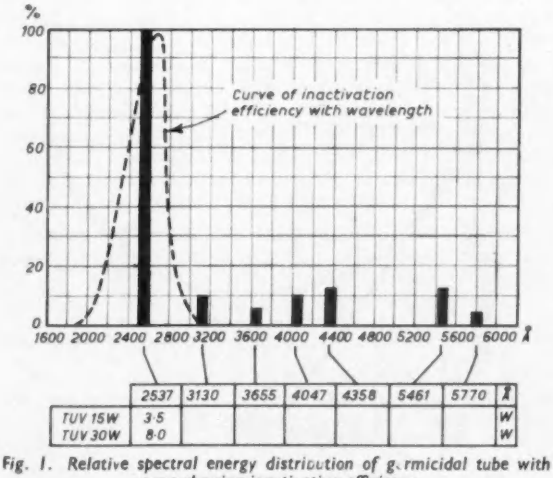


*Fig. 1. Relative spectral energy distribution of germicidal tube with curve showing inactivating efficiency*

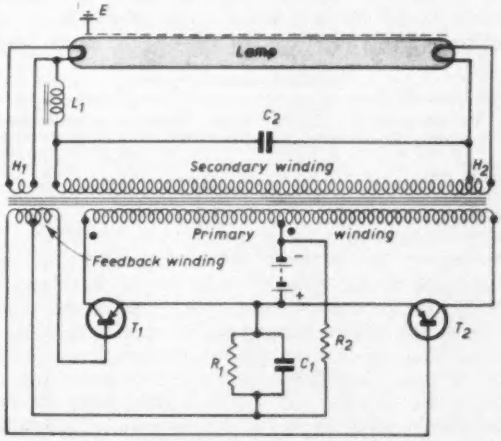


*Fig. 2. Circuit of transistor inverter unit suitable for operation of germicidal tubes*

In addition to these advantages it is possible with present transistor techniques to operate the ultra-violet tube on a 12 V or 24 V battery supply (Fig. 2), thus extending potential use of the unit to mobile equipment, such as ambulances and hospital ward trolleys.

In the instances of applications mentioned above, the apparatus would have to satisfy two main criteria: safety and simplicity of operation, and efficient performance.

An attempt has been made to embody these requirements in such an experimental apparatus, as illustrated in Fig. 3.

## Design Principles

Principles of design of the unit are shown in the cross-sectional sketch (Fig. 4). The irradiation chamber is formed by a cylindrical drum (a), fabricated with aluminium sheet having a high reflection factor to ultra-violet radiation. The cylinder is mounted and rotates upon the sheet metal base (b), housing a single 15 W, 18 in. germicidal

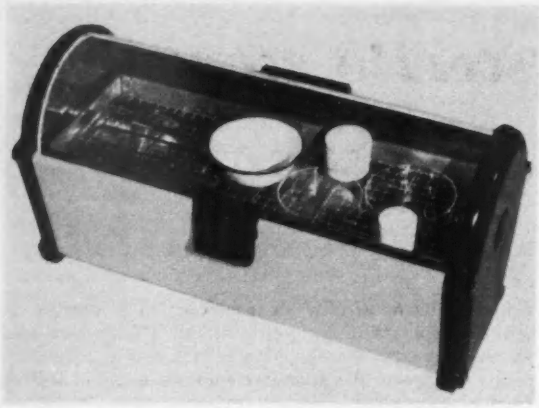

*Fig. 3. Experimental unit with cylinder in the open position*

tube and its control gear (c). The cylindrical drum forming the irradiation chamber has an aperture running its full length, so that when the cylinder is in the closed position this aperture coincides with the germicidal tube and permits radiation to enter the chamber without obstruction. With the cylinder in the open position the aperture forms a port by which objects are inserted or removed from the chamber.

When open, the cylinder automatically cuts off radiation from the chamber and therefore from the operator. The cylinder is counterbalanced so that it automatically rotates to the closed position upon release. If by some mischance the cylinder did not rotate to the closed position

**Table 2 shows exposure values**

| Max. safe exposure at right angles one 15 W tube | Distance from 15 W tube | Irradiation level micro watts/cm² |
|---|---|---|
| 24 hr | — | 0·1 |
| 12 hr | — | 0·3 |
| 6 hr | 23 ft | 0·6 |
| 1 hr | 10 ft | 3·6 |
| 30 min | 6 ft | 7·2 |
| 1 min | 14 in. | 216·0 |

the apparatus still "fails safe," no UV being able to enter the irradiation chamber and thereby affect the operator through the still open aperture. It is principally for this reason that use of a contact breaker has been avoided in this instance. A stainless steel wire tray (d) is suspended within the cylinder and forms a shelf upon which the objects for sterile storage or disinfection are supported.

In respect of the general question of safety, it should be noted that over-exposure to radiation from the germicidal tube is comparable with over-exposure to sunlight; namely, erythema and irritation of the conjunctiva of the eye.

As the UV tube is not visible at any time, its correct operation can be indicated only by the use of a visual signal. This is simply provided by a series indicator lamp connected into the circuit of the germicidal tube.

The extent of the results of exposure depend upon the dosage required. This is the product of the intensity of radiation and the exposure time. Table 2 shows values of safe exposure several dosages related to distance from a 15 W germicidal tube. This table also shows the variation of irradiation levels with distance from the source.

Results of over-exposure do not normally carry any lasting effect, but are naturally to be avoided, hence the insistence upon safety and simplicity of operation in the design criteria and execution. Accepting the efficiency of radiation in destroying micro-organisms, the second principle of design depends upon the maintenance of "sterile" conditions within the storage chamber. In view of the fact that ultra-violet radiation has, for practical purposes, no penetrative powers, maintenance of this condition depends to a great extent upon the design of interior surfaces. These surfaces should have as high a UV reflection factor as possible and be so shaped as to bring about multiple inter-reflections. By this means, objects within the chamber (i.e., constructional members, supporting tray, etc.) do not cast "shadows" or areas where the level of irradiation is low.

## Bacteriological Tests

The performance of the design can only be assessed by bacteriological tests. Whilst a detailed discussion on such techniques would be out of place in the present article, a brief explanation, with a summary of results of experiments is an essential in evaluating the design. In the first of the tests prepared bacterial cultures were spread on the surfaces of glass plates containing a nutrient solution, hardened yeastrel agar. Plates were then placed upside down on the supporting tray within the storage chamber, apart from one plate retained as a control. The plates within the storage chamber were irradiated for 1 min, 3 min and 5 min, respectively, and then incubated for 24 hr at 37°C. Counts were then made of bacterial colonies visible on the plates, and the percentage kill given below was a ratio of the number present on the control, or unirradiated, plate. One hundred per cent kill, or inactivation, was reported when no growth resulted upon the irradiated plate.

**Table 3 shows % of kill**

| Organism | Control Count | Time of Irradiation (Min) Percentage Kill | | |
|---|---|---|---|---|
| | | 1 | 3 | 5 |
| E. Coli, Type I ... ... | Greater than 500 | 100 | 100 | 100 |
| Pyocyaneus... ... ... | Greater than 500 | 100 | 100 | 100 |
| | c.500 | 100 | 100 | 100 |
| | c.500 | 100 | 100 | 99·8* |
| Staph. Aureus ... ... | c.300 | 99·7 | 100 | 100 |
| | 280 | 100 | 100 | 100 |
| | c.500 | 100 | 100 | 100 |
| | c.550 | 100 | 100 | 100 |

*Greater than

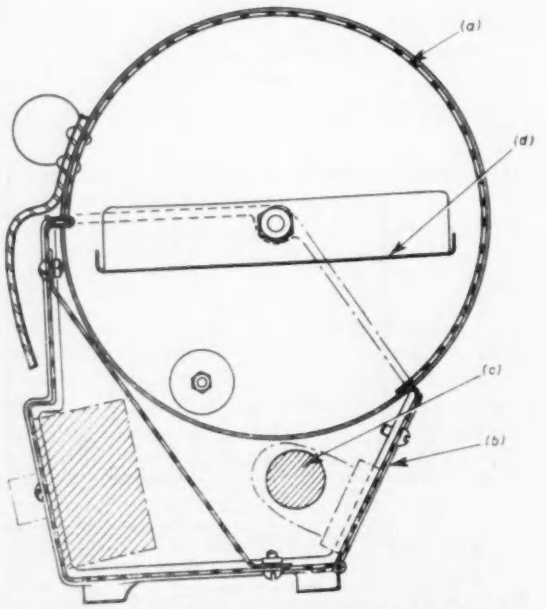


*Fig. 4. Cross-section through unit showing principal components*

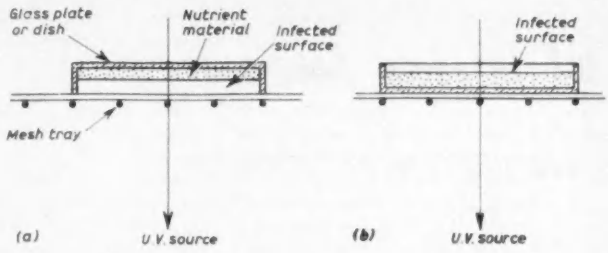


*Fig. 5. Relative position of infected surfaces to germicidal tube*

In the above test the plate carrying micro-organisms is upside down as Fig. 5a; therefore, the stainless steel wire tray is interposed between the primary source of radiation and the surface of the agar on which the various organisms are spread. The second test was carried out in the same manner with the exception that plates are placed on the tray right way up, as in Figs. 5b and 5c. Glass plates are opaque to short wavelength ultra-violet radiation, thus organisms on the surface of the agar could not receive radiation directly from the primary source. In the case of plates mounted as in Fig. 5c, the wire tray acted as a further obstruction to radiation. Inactivation could, therefore, only result from radiation occurring from inter-reflections within the chamber. Results of the second test are given in Table 4.

**Table 4 gives percentage of kill**

| Organism | Control Count | Time of Irradiation (Min) Percentage Kill | | |
|---|---|---|---|---|
| | | 1 | 3 | 5 |
| E. Coli, Type I ... ... | c.200 | 100 | 100 | 100 |
| Right way up ... ... | Greater than 500 | 100 | 100 | 100 |
| Suspended ... ... | c.200 | 100 | 100 | 100 |
| Under grid ... ... | Greater than 500 | 100 | 100 | 100 |
| Pyocyaneus... ... ... | c.200 | 100 | 100 | 100 |
| Right way up ... ... | Greater than 500 | 100 | 100 | 99·8* |
| Suspended ... ... | c.200 | 100 | 100 | 100 |
| Under grid ... ... | Greater than 500 | 100 | 100 | 100 |
| Staph. Aureus ... ... | 120 | 100 | 100 | 100 |
| Right way up ... ... | 520 | 99·4 | 100 | 100 |
| Suspended ... ... | 120 | 100 | 100 | 100 |
| Under grid ... ... | 520 | 100 | 100 | 100 |

*Greater than

## Sterile Storage

Comparison of the results in Tables 3 and 4 shows that position of the plates makes no difference to the recorded kill or inactivation of organisms investigated. From a theoretical investigation of the form of internal reflection characteristics and the above results, a conclusion may be drawn that radiation intensity throughout the volume of the storage chamber is substantially uniform. It is also largely independent of directional reference to the primary source of radiation. It must be emphasised that the foregoing tests were designed to investigate efficiency of design as a sterile storage device, this assuming that articles inserted in the chamber are already sterile, drugs, instruments, etc. It is evident and, indeed, necessary for this purpose that the device must be capable of inactivating micro-organisms gaining access to the enclosure.

Results obtained lead to the conclusion that radiation is capable of maintaining a sterile atmosphere within the storage chamber and actively disinfecting heavily contaminated simple surfaces in a relatively short time.

## Possible Extension of Use

The penetrative powers of short wavelength UV radiation are, however, very limited, hence the possibilities of actual disinfection—as opposed to sterile storage—of contaminated articles with complex shapes by means of UV tends to be disputed.

In order to investigate the full capabilities of the sterile storage device, a further series of bacterial tests needed to be carried out with common objects representing more complex surfaces, such as knives, forks, combs, brushes—polythene moulded type with separated bristles—and toothbrushes. The same types of organisms were used as in previous tests. All articles were dipped into a 10% suspension of the respective bacterial culture for 1 min and drained for 1 hr. One article of each type was then rinsed in a 50 ml Ringer solution for 15 min and the Ringer solution plated; these articles not being irradiated

**Table 5 gives rate of kill on irregular shapes**

| Article | Organism | Control Count | Time of Irradiation (Min) Percentage Kill | |
|---|---|---|---|---|
| | | | 3 | 5 |
| Knife ... ... | E. Coli, Type I ... | 83,000 | 99·9* | 99·8* |
| Fork ... ... | E. Coli, Type I ... | 380,000 | 99·2* | 99·8* |
| Knife ... ... | Pyocyaneus ... | 160,000 | 100·0 | 99·9* |
| Fork ... ... | Pyocyaneus ... | 34,000 | 99·5 | 99·8* |
| Knife ... ... | Staph. Aureus ... | 10,000 | 80·0 | 99·0 |
| Fork ... ... | Staph. Aureus ... | 8,000 | 97·5 | 99·0* |
| Combs ... | E. Coli, Type I ... | 1,250,000 | 99·98* | 99·99* |
| Brushes ... | E. Coli, Type I ... | 170,000 | 100·0 | 99·97 |
| Toothbrushes... | E. Coli, Type I ... | 20,000,000 | 99·4 | 99·9 |
| Combs ... | Pyocyaneus ... | 10,150,000 | 99·999 | 99·999* |
| Brushes ... | Pyocyaneus ... | 950,000 | 98·4 | 99·995 |
| Toothbrushes... | Pyocyaneus ... | 13,000,000 | 97·3 | 99·75 |
| Combs ... | Staph. Aureus ... | 3,000 | 96·7 | 96·7 |
| Brushes ... | Staph. Aureus ... | 17,500 | 89·0 | 99·4 |
| Toothbrushes... | Staph. Aureus ... | 4,300,000 | 97·2 | 89·0 |

*Greater than

and kept as controls. Infected articles for irradiation were then placed in the storage chamber for 5 min and 10 min, respectively, then removed, rinsed and plated. The results are given in Table 5. The same incubation and counting procedure is followed as given for previous tests.

Results confirm that disinfection of complex surfaces is a more difficult proposition, but they serve to indicate that even with highly complex surfaces UV radiation is still capable of considerably reducing contamination level. In view of increasing numbers of materials, containers and instruments, which cannot be subjected to high temperatures or disinfectant fluids associated with conventional sterilisers, the action of UV irradiation in conjunction with simple cleansing might offer advantages where conventional methods are impossible to apply.

Perhaps the most common application of ultra-violet radiation is air disinfection. In this particular field of use the method is uniquely successful, as for practical purposes the atmosphere is transparent to radiation at 2537 over the ranges met in office and factory. The micro-organisms suspended in the air can, therefore, be readily irradiated. The same reasoning can be applied to micro-organisms spread across a flat or simple plane surface where again the organisms can be fully subjected to the radiation. This also applies to micro-organisms suspended in some liquids which have a reasonable transmission to short wavelength ultra-violet radiation.

**Acknowledgment:** Experimental equipment shown in Fig. 3 was made up by Jacob White and Co.

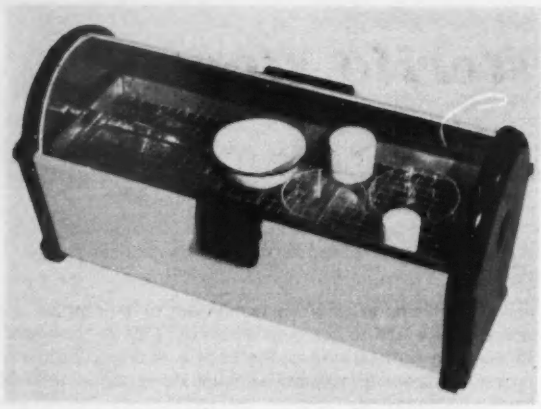

*Fig. 3. Experimental unit with cylinder in the open position*

tube and its control gear (c). The cylindrical drum forming the irradiation chamber has an aperture running its full length, so that when the cylinder is in the closed position this aperture coincides with the germicidal tube and permits radiation to enter the chamber without obstruction. With the cylinder in the open position the aperture forms a port by which objects are inserted or removed from the chamber.

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| 30 min | 6 ft | 7·2 |
| 1 min | 14 in. | 216·0 |

the apparatus still "fails safe," no UV being able to enter the irradiation chamber and thereby affect the operator through the still open aperture. It is principally for this reason that use of a contact breaker has been avoided in this instance. A stainless steel wire tray (d) is suspended within the cylinder and forms a shelf upon which the objects for sterile storage or disinfection are supported.

In respect of the general question of safety, it should be noted that over-exposure to radiation from the germicidal tube is comparable with over-exposure to sunlight; namely, erythema and irritation of the conjunctiva of the eye.

As the UV tube is not visible at any time, its correct operation can be indicated only by the use of a visual signal. This is simply provided by a series indicator lamp connected into the circuit of the germicidal tube.

The extent of the results of exposure depend upon the dosage required. This is the product of the intensity of radiation and the exposure time. Table 2 shows values of safe exposure several dosages related to distance from a 15 W germicidal tube. This table also shows the variation of irradiation levels with distance from the source.

Results of over-exposure do not normally carry any lasting effect, but are naturally to be avoided, hence the insistence upon safety and simplicity of operation in the design criteria and execution. Accepting the efficiency of radiation in destroying micro-organisms, the second principle of design depends upon the maintenance of "sterile" conditions within the storage chamber. In view of the fact that ultra-violet radiation has, for practical purposes, no penetrative powers, maintenance of this condition depends to a great extent upon the design of interior surfaces. These surfaces should have as high a UV reflection factor as possible and be so shaped as to bring about multiple inter-reflections. By this means, objects within the chamber (i.e., constructional members, supporting tray, etc.) do not cast "shadows" or areas where the level of irradiation is low.

## Bacteriological Tests

The performance of the design can only be assessed by bacteriological tests. Whilst a detailed discussion on such techniques would be out of place in the present article, a brief explanation, with a summary of results of experiments is an essential in evaluating the design. In the first of the tests prepared bacterial cultures were spread on the surfaces of glass plates containing a nutrient solution, hardened yeastrel agar. Plates were then placed upside down on the supporting tray within the storage chamber, apart from one plate retained as a control. The plates within the storage chamber were irradiated for 1 min, 3 min and 5 min, respectively, and then incubated for 24 hr at 37°C. Counts were then made of bacterial colonies visible on the plates, and the percentage kill given below was a ratio of the number present on the control, or unirradiated, plate. One hundred per cent kill, or inactivation, was reported when no growth resulted upon the irradiated plate.

**Table 3 shows % of kill**

| Organism | Control Count | Time of Irradiation (Min) Percentage Kill | | |
|---|---|---|---|---|
| | | 1 | 3 | 5 |
| E. Coli, Type 1 | Greater than 500 | 100 | 100 | 100 |
| Pyocyaneus | Greater than 500 | 100 | 100 | 100 |
| | c.500 | 100 | 100 | 100 |
| | c.500 | 100 | 100 | 99·8* |
| Staph. Aureus | c.300 | 99·7 | 100 | 100 |
| | 280 | 100 | 100 | 100 |
| | c.500 | 100 | 100 | 100 |
| | c.550 | 100 | 100 | 100 |

*Greater than

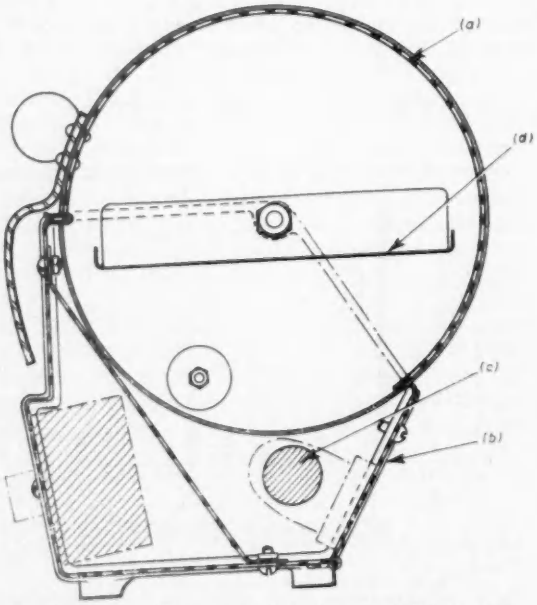


*Fig. 4. Cross-section through unit showing principal components*

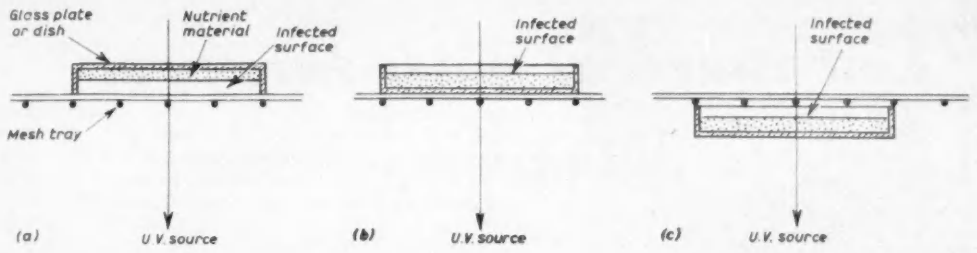


*Fig. 5. Relative position of infected surfaces to germicidal tube*

In the above test the plate carrying micro-organisms is upside down as Fig. 5a; therefore, the stainless steel wire tray is interposed between the primary source of radiation and the surface of the agar on which the various organisms are spread. The second test was carried out in the same manner with the exception that plates are placed on the tray right way up, as in Figs. 5b and 5c. Glass plates are opaque to short wavelength ultra-violet radiation, thus organisms on the surface of the agar could not receive radiation directly from the primary source. In the case of plates mounted as in Fig. 5c, the wire tray acted as a further obstruction to radiation. Inactivation could, therefore, only result from radiation occurring from inter-reflections within the chamber. Results of the second test are given in Table 4.

**Table 4 gives percentage of kill**

| Organism | Control Count | Time of Irradiation (Min) Percentage Kill | | |
|---|---|---|---|---|
| | | 1 | 3 | 5 |
| E. Coli, Type I ... ... | c.200 | 100 | 100 | 100 |
| Right way up ... ... | Greater than 500 | 100 | 100 | 100 |
| Suspended ... ... | c.200 | 100 | 100 | 100 |
| Under grid ... ... | Greater than 500 | 100 | 100 | 100 |
| Pyocyaneus... ... | c.200 | 100 | 100 | 100 |
| Right way up ... ... | Greater than 500 | 100 | 100 | 99·8* |
| Suspended ... ... | c.200 | 100 | 100 | 100 |
| Under grid ... ... | Greater than 500 | 100 | 100 | 100 |
| Staph. Aureus ... ... | 120 | 100 | 100 | 100 |
| Right way up ... ... | 520 | 99·4 | 100 | 100 |
| Suspended ... ... | 120 | 100 | 100 | 100 |
| Under grid ... ... | 520 | 100 | 100 | 100 |

*Greater than

## Sterile Storage

Comparison of the results in Tables 3 and 4 shows that position of the plates makes no difference to the recorded kill or inactivation of organisms investigated. From a theoretical investigation of the form of internal reflection characteristics and the above results, a conclusion may be drawn that radiation intensity throughout the volume of the storage chamber is substantially uniform. It is also largely independent of directional reference to the primary source of radiation. It must be emphasised that the foregoing tests were designed to investigate efficiency of design as a sterile storage device, this assuming that articles inserted in the chamber are already sterile, drugs, instruments, etc. It is evident and, indeed, necessary for this purpose that the device must be capable of inactivating micro-organisms gaining access to the enclosure.

Results obtained lead to the conclusion that radiation is capable of maintaining a sterile atmosphere within the storage chamber and actively disinfecting heavily contaminated simple surfaces in a relatively short time.

## Possible Extension of Use

The penetrative powers of short wavelength UV radiation are, however, very limited, hence the possibilities of actual disinfection—as opposed to sterile storage—of contaminated articles with complex shapes by means of UV tends to be disputed.

In order to investigate the full capabilities of the sterile storage device, a further series of bacterial tests needed to be carried out with common objects representing more complex surfaces, such as knives, forks, combs, brushes—polythene moulded type with separated bristles—and toothbrushes. The same types of organisms were used as in previous tests. All articles were dipped into a 10% suspension of the respective bacterial culture for 1 min and drained for 1 hr. One article of each type was then rinsed in a 50 ml Ringer solution for 15 min and the Ringer solution plated; these articles not being irradiated

**Table 5 gives rate of kill on irregular shapes**

| Article | Organism | Control Count | Time of Irradiation (Min) Percentage Kill | |
|---|---|---|---|---|
| | | | 3 | 5 |
| Knife ... ... | E. Coli, Type I ... | 83,000 | 99·9* | 99·8* |
| Fork ... ... | E. Coli, Type I ... | 380,000 | 99·2* | 99·8* |
| Knife ... ... | Pyocyaneus ... | 160,000 | 100·0 | 99·9* |
| Fork ... ... | Pyocyaneus ... | 34,000 | 99·5 | 99·8* |
| Knife ... ... | Staph. Aureus ... | 10,000 | 80·0 | 99·0 |
| Fork ... ... | Staph. Aureus ... | 8,000 | 97·5 | 99·0* |
| Combs ... | E. Coli, Type I ... | 1,250,000 | 99·98* | 99·99* |
| Brushes ... | E. Coli, Type I ... | 170,000 | 100·0 | 99·97 |
| Toothbrushes... | E. Coli, Type I ... | 20,000,000 | 99·4 | 99·9 |
| Combs ... | Pyocyaneus ... | 10,150,000 | 99·999 | 99·999* |
| Brushes ... | Pyocyaneus ... | 950,000 | 98·4 | 99·995 |
| Toothbrushes... | Pyocyaneus ... | 13,000,000 | 97·3 | 99·75 |
| Combs ... | Staph. Aureus ... | 3,000 | 96·7 | 96·7 |
| Brushes ... | Staph. Aureus ... | 17,500 | 89·0 | 99·4 |
| Toothbrushes... | Staph. Aureus ... | 4,300,000 | 97·2 | 89·0 |

*Greater than

and kept as controls. Infected articles for irradiation were then placed in the storage chamber for 5 min and 10 min, respectively, then removed, rinsed and plated. The results are given in Table 5. The same incubation and counting procedure is followed as given for previous tests.

Results confirm that disinfection of complex surfaces is a more difficult proposition, but they serve to indicate that even with highly complex surfaces UV radiation is still capable of considerably reducing contamination level. In view of increasing numbers of materials, containers and instruments, which cannot be subjected to high temperatures or disinfectant fluids associated with conventional sterilisers, the action of UV irradiation in conjunction with simple cleansing might offer advantages where conventional methods are impossible to apply.

Perhaps the most common application of ultra-violet radiation is air disinfection. In this particular field of use the method is uniquely successful, as for practical purposes the atmosphere is transparent to radiation at 2537 over the ranges met in office and factory. The micro-organisms suspended in the air can, therefore, be readily irradiated. The same reasoning can be applied to micro-organisms spread across a flat or simple plane surface where again the organisms can be fully subjected to the radiation. This also applies to micro-organisms suspended in some liquids which have a reasonable transmission to short wavelength ultra-violet radiation.

**Acknowledgment:** Experimental equipment shown in Fig. 3 was made up by Jacob White and Co.

# Low thermal mass furnace

## ECONOMY AND TECHNICAL ADVANTAGE OFFERED

by R. M. Glashen, M.B.E., C.G.I.A., M.I.E.E., A.M.I.Mech.E.*

THE author began developing the low thermal mass furnace about four years ago. It is used primarily for stress-relieving of welded structures, but is capable of other operations. Its economics are startling —one-quarter or less of the cost of conventional furnaces —fuel costs comparable with those of gas or oil furnaces on full load, and much less on partial loads—negligible maintenance costs—automatic operation and virtually no labour costs—up to three times the throughput of conventional furnaces of the same size, and elimination of job scaling thrown in as a side benefit.

### Conception and Development

At the urgent request of John Thompson (Wilson Boilers) Ltd., of Glasgow, the South of Scotland Electricity Board Industrial Advisory Service had designed a large heater to be used for pre-heating to 200°C, 16 11-ton assemblies destined for Berkeley nuclear station. The equipment was constructed in a few days from domestic cooker grill boiler hotplates. It was very successful, and costs were so low that a director of John Thompson's casually remarked to the author that a real boon to them would be an electric means of stress-relieving their famous range of "Multipac" welded boilers, if the electrical equipment construction and operating costs were as relatively low as had been those for the pre-heating rig.

Stress-relieving is the heating of welded structures to red heat for a short time. It is necessary because shrinkage of weld metal sets up very high tensile stresses in the region of certain types of weld. These stresses might well cause rupture of the welded seam if normal working forces were superimposed. If the metal is weakened sufficiently by heating, creep can take place in the hot metal under the influence of the stresses until the latter are reduced to an acceptably low value.

It needed only a few calculations to show that under optimum conditions it should be possible to raise a ton of steel to stress-relieving temperature for about 10s worth of electricity, on one of the South of Scotland Electricity Board's off-peak tariffs. As John Thompson's reckoned that at that time it was costing over £9/ton to send out their work for stress-relieving, and all of the world's day-to-day stress-relieving work was being carried out in fuel-fired furnaces, clearly there was a case for investigation.

Experiments carried out by the Board confirmed the low cost of electricity needed for such operations, and work was started on devising the best means of application.

A high proportion of the heat input to even the best of conventional furnaces is soaking into massive walls and passing out of flues in waste gases, rather than going into the workpiece. To avoid these disadvantages, the first approach to the problem was virtually to make the job to be stress-relieved act as its own furnace by locating the heat source inside the job. For this purpose, an electric heater was developed to work at ordinary mains voltages, rated at 4 kW/ft run in surroundings at 650°C. The heater comprises tubular units 8 in. dia. and 6 ft long, which can be bolted end-to-end to form a single heater of any length up to 60 ft, requiring an electricity supply at one end only. Such heaters are intended to be inserted into boilers and similar structures, which are then covered with thermal insulation and brought up to stress-relieving temperature.

This is a most useful system for very large welded vessels, but it is not easily applicable to flat or irregular shapes, and a disproportionate amount of labour is required to fit the heaters into small boilers. Attention was therefore turned to other ways of applying electroheat, still keeping rigidly to the idea behind the tubular heaters, that as high a proportion as possible of the heat used should go into the job itself.

The outcome was a large diving-bell type of construction to lower over the job (Fig. 1). The 3 in. thick moulded block walls of the bell were thinner and lighter than had ever before been used in furnaces to operate at that temperature. The only brickwork used was in the form of a few circumferential runs at intervals up the sides to carry heating elements, which were disposed over all internal surfaces. Virtually all internal metalwork had been eliminated. To cater for loads of varied shapes, small holes with removable stoppers were left in the base so that job supports could be plugged through to the cool steelwork beneath.

The entire furnace, having clear internal dimensions of 18 ft by 12 ft by 12 ft, was so light that it was possible to mount it on roller bearing wheels and tow it across Thompson's factory complete with a 25-ton load, by means of a fork-lift truck. This light weight meant also that the furnace could be built completely in a works in England, brought by road to Scotland, and commissioned immediately.

Since that date, more than a year has passed; the conception has proved entirely successful as the following operational results will show.

### Direct Advantages

Direct advantages of the furnace have been low capital cost, low operating costs and negligible maintenance costs.

One characteristic of the low thermal mass form of construction is its low cost. The John Thompson furnace with clear internal dimensions 12 ft high by 12 ft wide by 18 ft long costs less than £6,500 as compared with capital costs four times or more as great for conventional furnaces of the same cubic capacity. This low capital sum was fully recovered by John Thompsons through *direct* savings in stress-relieving contract costs over less than 12 months.

During the year, 950 tons of boilers were stress-relieved

* Mr Glashen is head of Industrial Development Section, South of Scotland Electricity Board.

in 141 heats, at an average cost for electricity of £1 0s 3d/ton. This cost compares favourably with the known fuel costs of fuel-fired furnaces of this size.

The actual cost of operation was well above the minimum possible cost, because the furnace was almost invariably only part-loaded with less than seven tons. It was, in fact, designed to take a 13-ton optimum normal load and occasional 25-ton loads. Other firms might find it convenient to operate regularly a heavier loading policy, and Fig. 3, which has been derived from an analysis of the past year's working, shows the relationship between furnace load and cost of electricity/ton of load, for stress-relieving. Supply was given on the SSEB Off-peak Tariff No. 1 (0·75d/unit).

Labour is required only for the 20 minutes needed to unload and reload the furnace. Operation is fully automatic under the control of three cam-type regulators, which are brought into operation by means of a time switch at night time when the factory is deserted.

The complex temperature and time schedule prescribed by BS 1500: Fusion-welded Pressure Vessels is closely adhered to and furnace temperature is charted to satisfy the boiler insurance inspectors.

The only maintenance necessary during the year was replacement of a single thermal insulation block, which was displaced during delivery, and the repair by welding of an open-circuited element. Both the thermal insulation and the elements are operating at temperatures well below their permitted maxima; there is no deterioration visible in either, and it is expected with confidence that no maintenance will be required for some years.

Replacement of the whole thermal insulation lining and the elements, when it finally becomes necessary, will be an inexpensive procedure compared with the re-bricking of a conventional furnace.

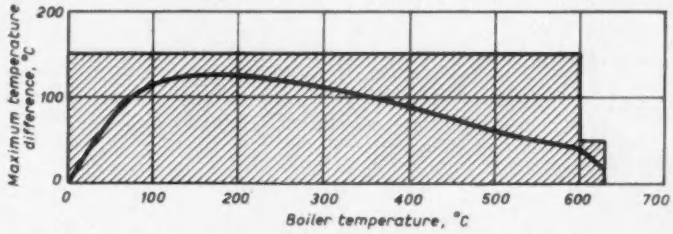


*Fig. 2. Maximum temperature gradient in boiler during stress relief. The hatched area indicates BS 1500 limits*

## Indirect Advantages

The indirect financial advantages of the low thermal mass electric furnace are so outstanding that they even outweigh the direct advantages.

For the average load, a complete cycle of loading, stress-relieving and reloading can be completed in less than 24 hr. The one-day heating, cooling and reloading cycle on normal loading gives up to 200% greater throughput compared with a much more expensive conventional furnace occupying the same amount of floor space.

The low level of temperature gradients throughout a boiler being stress-relieved is noteworthy, and the extent by which the gradients fall within the limits prescribed by BS 1500 is shown in Fig. 2.

Structures of such mechanical complexity with parts forming internal radiation barriers had not previously been stress-relieved by a heat source of a predominantly radiant nature. It was not, in fact, possible to calculate in advance what the gradients would be, and the firm constructing the furnace would not guarantee acceptable

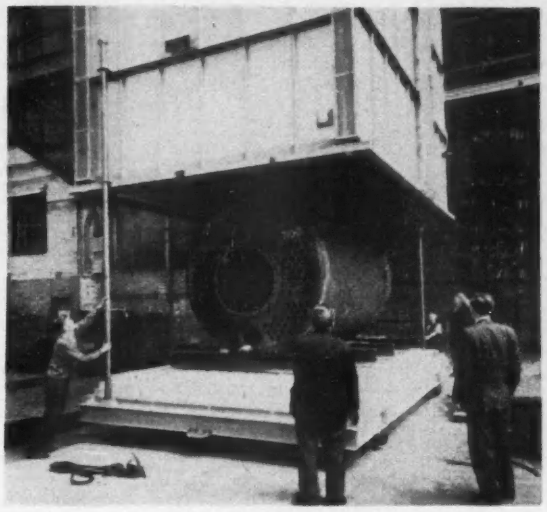

*Fig. 1. Typical furnace in use*

results. The SSEB, however, promised John Thompson's that they would if necessary, modify the design and construction of the furnace to make it give results within the limits prescribed by BS 1500. No modifications were needed though, as temperature gradients from the start were well within the BS 1500 requirements.

The diving-bell form of furnace construction tends to trap hot air, and when the oxygen in that air has combined with the workpiece, the atmosphere remaining is non-oxydising. The effect of any small air leakages which might exist is minimised by the short time cycle for the heating operation. It has been found in practice that scaling is entirely eliminated; the jobs are covered with only a light dusting of oxide.

Direct financial savings on scaling costs are estimated by John Thompsons to be worth at least as much as the total amount of electricity consumed for stress-relieving.

## Aids to Productivity

The several advantageous features of the low thermal mass furnace have had a cumulative effect on productivity. It would be difficult to place a cash value on these production aspects, but they clearly must represent an additional financial saving as important as the direct and indirect economic advantages listed above.

The extremely slow rate of deterioration of furnace

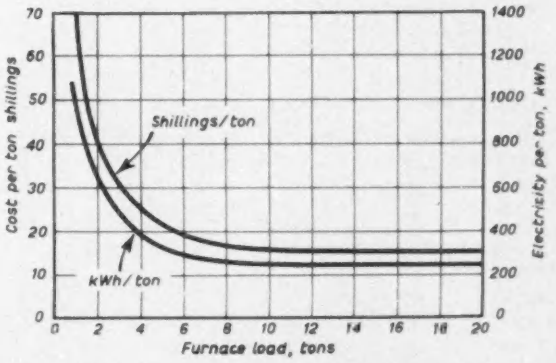


*Fig. 3. Electricity (and cost) per ton of work stress-relieved*

elements and lining will give an almost total freedom from furnace outages. Such outages with fuel-fired plant are often unplanned, frequently extend to weeks at a time, and have an adverse influence on production flow.

Operating costs are so low that it has been found economic to load the furnace at times with as little as one small boiler if this procedure would serve to hasten the production schedule. This feature has proved of great benefit to John Thompsons, who use the furnace as a production tool. They have never needed to wait for a full furnace load to accumulate when the financial penalties of partial loads have been so slight.

Production advantages of rapid throughput are most marked where jobs have previously had to be sent out for contract stress-relieving. Transport time, waiting time at the contractor's works for a full furnace load to accumulate, and a long stress-relieving time cycle in a conventional furnace before the job was returned, used to take anything up to ten days for each of John Thompson's boilers. Accurate preplanning of further production processes used to be impossible because of the indeterminate date of return from stress-relieving.

Elimination of the scaling operation has resulted in shorter overall process times, and the freeing of floor space formerly required for this operation has played its part in the achievement of a rapid expansion of boiler production. There has also been a marginal benefit to John Thompson's customers from the increased boiler strength where the steelwork has retained its full original thickness.

The furnace described above was constructed by Shelley Electric Furnaces Ltd., Stoke-on-Trent, who now have others under construction. G.W.B. Furnaces Ltd., Dudley, Worcs, also have designed furnaces of the low thermal mass type with the co-operation of the South of Scotland Electricity Board.

A 16 mm colour film with magnetic sound track, showing form of construction and methods of operation of the low thermal mass furnace, has been produced by the Commercial Department of the South of Scotland Electricity Board, and is available for free loan to interested parties from SSEB Head Office, Inverlair Avenue, Glasgow S.4.

## Acknowledgments

The author wishes to acknowledge the encouragement and support for the project which he received from Mr V. S. Ruff, managing director of John Thompson (Wilson Boilers) Ltd., and from the main board of the John Thompson Group of Companies.

The low thermal mass furnace development programme was initiated and financed by the SSEB Commercial Department and conducted through its Industrial Advisory Service.

# Power Future Survey

BY the mid-1970s, over 50% of the national requirements of electricity will be passing over high-voltage, long-distance transmission lines, compared with only about 7% at present. This is one of a number of statistics for the future which CEGB chairman Sir Christopher Hinton included in a lecture last week. He was speaking to the Stoke-on-Trent Association of Engineers, which had awarded him its Reginald Mitchell Memorial Gold Medal.

Sir Christopher repeated what had been said before, that the planned step from 275 kV to 400 kV for transmission offers no great economic advantage in this country. The determining advantage of the step in voltage is that three times as much power can be transmitted over a single circuit. The impact of the transmission lines on the countryside is thus reduced.

It is not technical problems that provide the greatest difficulty about expansion of the electricity supply industry. It is the task of meeting the demand for electricity—and so for greater material amenity—without too great a sacrifice of visual amenity that presents the greatest difficulty. This problem is unlikely to grow less with passage of time.

## Generation Economics

On the question of generation economics, Sir Christopher noted that the move to pressures and temperatures higher than 2,300 lb/sq in., 1,050°F, which are being used today, involves a move to markedly more expensive materials. Plans such as those of the CEGB for supercritical sets operating at 3,500 lb/sq in., 1,100°F involve extra costs "hardly repaid by the increase in efficiency which is achieved." He expressed confidence, however, in the eventual fall in the prices of the special materials needed. He had no doubt that supercritical plants would be used extensively in the future.

Whereas power stations working at 600 lb/sq in., 850°F cost £67/kW, even at 1948 prices, the 2,300 lb/sq in., 1,050°F stations of today are building for £37/kW. The cost reduction has had its effect on the economics of nuclear power, and these have been affected as well by increases in interest rates. Whereas in conventional stations the ratio of costs attributable to capital charges, to those attributable to fuel and operating expenses, is 1:4, in nuclear stations it is 2:1.

## Nuclear Outlook

The unit cost of nuclear-station-generated electricity is being brought down rapidly, partly by increasing the size of stations. Sir Christopher commented that the plan for 290 MW reactors for Sizewell at a time when the only reactors for which there was operating experience were 40 MW units at Calder Hall and Chapel Cross, represents "a rate of extrapolation of experience far greater than is welcome to responsible engineers." It is not without risk of failure.

Reduction in nuclear costs could come with using higher initial steam temperatures. This might be made possible by the advanced gas-cooled reactor design under development at Windscale—but Sir Christopher warned that "the AGR type of reactor will have some difficulty in establishing itself in competition with the Calder reactor, of which a good deal of experience has now been obtained with a steady reduction in cost."

Should nuclear stations figure in the British power programme? Sir Christopher suggested that the CEGB will need 130 million tons of coal equivalent by 1975. It did not appear reasonable to count on more than 100 million tons a year from the NCB, even in the long term. Nor did it seem wise to think of using residual fuel oils to any greater extent than they will be produced in British refineries—although to that extent they should be used. On this basis, from 1970, a three-fuel electricity generation pattern should be expected, including oil and nuclear power.

# Readers Views

*Correspondents writing under pseudonyms are asked to submit their names and addresses in confidence to the Editor*

## E.A.W. Activities

IN answer to *Peregrin's* query in the ELECTRICAL TIMES for 9 November, I would like to explain that the main object of the EAW's current campaign, "Electricity for Safety," is to demonstrate that electricity used safely and efficiently in the home can save far more accidents than the few it causes. I feel sure that *Peregrin* will agree that wider appreciation by the public of the need for better and more adequate wiring, better lighting, better planned kitchens and the careful choice of equipment, would make a big contribution towards home safety, but, as in all else, the public requires education, and this the EAW seeks to provide through its branches.

The EAW was appreciative of the excellent publicity given to the report of its "Electrical Viewpoint" survey in the ELECTRICAL TIMES of 5 October, under the heading of "Appliance Survey Points to Future Needs." *Peregrin* can be assured that the report has been distributed widely throughout the supply, manufacturing and contracting sides of the industry, as well as in other quarters, for the EAW believes that only by the closest co-operation of all concerned with electricity in the home can the user's needs be fully met. Copies of the report are also on sale at EAW Headquarters.

*Mary George*, M.B.E.,
DIRECTOR, ELECTRICAL ASSOCIATION FOR WOMEN,
LONDON W.1.

## Aluminium Busbars

IN his article on 9 November, Mr P. J. H. Rata states that "it is normal practice to use rectangular sections in electrical-purity aluminium" for busbars for electro-plating and electro-chemical plant, and that for factory busbars "aluminium alloy busbars with their greater mechanical strength are usually preferred." No doubt these remarks are intended to indicate the type of aluminium busbar which would be recommended in cases where their use in preference to copper busbars could be justified.

Mr Rata shows in Table 1 that hard drawn copper is stronger than the aluminium alloy E91E, but the comments I have quoted might give the impression that only aluminium busbars are considered for the types of installation in question. In point of fact, of course, copper busbars are extensively used in both forms of equipment.

*Veritas*,
LONDON.

## Off-peak Heating Control

THE correspondence from Mr Ian Maclaren regarding Mr Grant's article is interesting, but the divergence of views clearly indicates the need for further thought on the difficult subject of the control of off-peak electric heating.

I have operated electric under-floor heating in my own home for the last three winters, with complete instrumentation, including continuous records of inside, outside, under-floor and other temperatures associated with the control functions, with various schemes of control and my comments as below on Mr Maclaren's letter may be of interest.

In the first place, I found it difficult to understand Mr Maclaren's suggestion that a floor-warming system providing background heating can have its charge interrupted on the attainment of satisfactory comfort conditions by a temperature/time regulator which takes no account of inside comfort. Nor can I see, having regard to the great capacity and transfer lag of under-floor systems, the merit of attempting to interrupt background heating in the evening by room thermostats which must inevitably be affected by incidental heat which has no relation to the outside temperature.

I think that many thoughts on the characteristics of control of off-peak heating omit to take into account this large transfer lag in under-floor heating systems, and the continuous records which I have kept show conclusively that—

(a) the time of switching on, whether it be at the earliest or the last moment, is really irrelevant. The temperature rise in the evening resulting from prompt switching on at 7 p.m. is negligible compared with the temperature rise arising from incidental heat due to lighting, drawing of curtains and occupation.

(b) For the same reason switching off at 11 p.m. is equally unimportant.

(c) Likewise, mid-day boost is an expensive luxury.

Analysis of the results confirms what I believe theory confirms, i.e., that the most satisfactory solution at present available for either background or complete heating for a private house certainly is an outside controller—sensitive to wind as well as temperature—set to replace the losses from the building (so far as it is possible for a controller in circuit for 12 hr only to judge losses over 24 hr) and influenced by a detector inside which allows the outside controller to operate independently of rise of inside temperature due to incidental heating, but increases the rate of charge when, due to increased losses, the inside temperature is reduced.

The Ratiomatic scheme mentioned by Mr Grant leads us farthest in the above direction, but I am sure that further developments can be expected.

*M. J. Gartside*,
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SLOUGH, BUCKS.

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## Computers in Commerce and Industry

APPLICATIONS of computers to automatic data processing in commerce and to production control in industry are discussed in two recent publications. One is a DSIR-commissioned book, "Automatic Data Processing," by Mr D. Wragge Morley (HMSO, price 6s); the other "Computers and Production Control," the report of a sub-committee set up to study that subject by the Research and Technical Committee of the Institution of Production Engineers, by whom the report is published (price 7s 6d).

The DSIR publication reviews the growth of the automatic data processing industry in the UK, and examines practice today with an eye for weaknesses. An extensive appendix to the book describes British and other systems of data processing equipment available in the UK.

The IPE report seeks to take account of what it calls the almost complete lack of published information on the principles to be applied when considering the use of computers for production control. It includes four case studies.

# Motor terminal boxes

## NEW DESIGNS COUNTER EXPLOSION RISK

A FEW years ago there was a disturbing number of faults involving the terminal boxes of h.v. motors, typically 3·3 kV machines. These led to the destruction of the cast-iron boxes with an effect resembling an explosion. Similar faults occurred on other types of electrical equipment. The resulting investigations showed the way to a complete redesign of termination equipment. The basis of the new design and some of the forms it takes are discussed by Mr K. K. Schwarz, M.A., A.M.I.E.E., in a paper* presented last week to the IEE Utilisation Section.

Causes of faults in terminal boxes can be grouped under four headings: contamination, cable connections, box design and voltage surges. The most common evidence in boxes which had failed was an excessive amount of moisture and dirt deposited inside the box. Moisture was generally found lying on the sealing compound. Electrolytic action under electric stress had usually led to a breakdown of the cable and compound surface, with a short-circuit the result. In totally enclosed machines, the moisture was found to accumulate preferentially in the terminal box, which stayed cool relative to the rest of the motor.

If a short-circuit develops inside a terminal box, then an arc power as high as 30 MVA may exist in a containment 1½ cu ft volume. (This assumes 3 in. electrode separation for a 3·3 kV motor and 250 MVA supply short-circuit potential.)

### Design Approach

With this background, an obvious first priority is to minimise the amount of water and other contamination that can enter the termination enclosure. This involves having a box that is fully gasketed and sealed from the motor it serves. Leads passing from the back of the box into the motor are fitted into a tube, which is sealed. A steel box is used to increase strength against internal explosion. As another precaution against accumulation of moisture, a desiccator is fitted.

Experience suggests that the most likely place for breakdown is an open metallic part at line potential. This is taken into account by designing with ease of taping open metal parts in mind. In one design, a "connector" is used, consisting of a copper rod moulded into a high-density polythene sleeve. Incoming and motor cable sockets are bolted to the connector ends.

If a fault develops within the motor windings, then a relatively large current will flow through the terminals of the motor. Specific steps are taken in terminal box design to prevent a "through-fault" developing into a box fault. Provision of adequate mechanical strength is a first consideration; thereafter, the conditions of cables and any joints need attention. Crimped joints are preferred to soldered connections (brazing is inconvenient). It is suggested that the use of soldered joints should be limited to nominal maximum cable temperatures of 160°C, corresponding to a current density of 175 kA/sq in. The limit recommended for other cables within the box is 260 kA/sq in.

The design precautions described make it unlikely that the terminal box will develop a fault. However, it has also become clear that if such a fault develops the fault energy cannot be contained within an economically feasible terminal box. To check the factors involved, the ERA carried out a number of tests which, amongst other matters, gave attention to the possibility of venting the box.

From the ERA tests, design criteria were established for an all-steel welded terminal box which would withstand a design pressure of 200 lb/sq in. calculated at stresses below u.t.s. of the steel. The design evolved

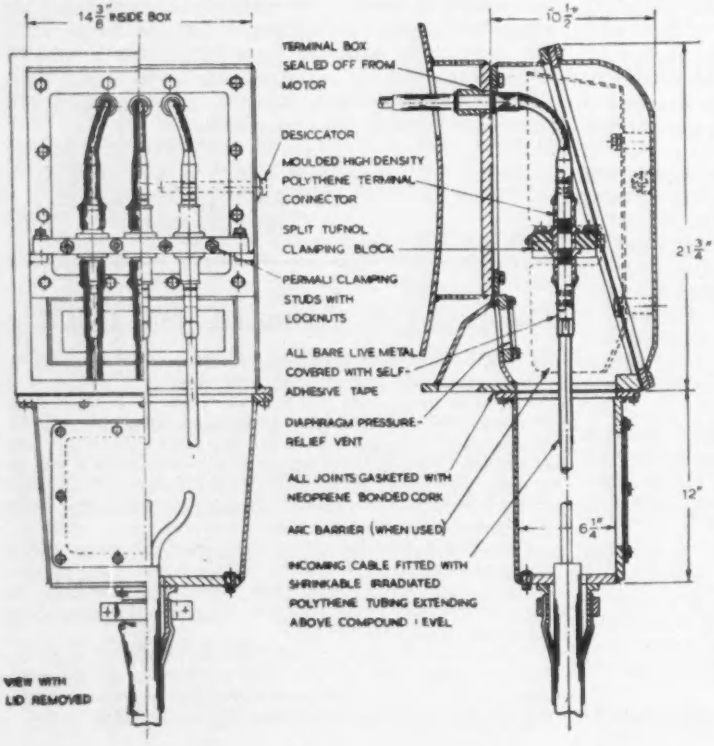

14 3/8" INSIDE BOX
10 1/2"
TERMINAL BOX SEALED OFF FROM MOTOR
DESICCATOR
MOULDED HIGH DENSITY POLYTHENE TERMINAL CONNECTOR
SPLIT TUFNOL CLAMPING BLOCK
PERMALI CLAMPING STUDS WITH LOCKNUTS
ALL BARE LIVE METAL COVERED WITH SELF-ADHESIVE TAPE
DIAPHRAGM PRESSURE-RELIEF VENT
ALL JOINTS GASKETED WITH NEOPRENE BONDED CORK
ARC BARRIER (WHEN USED)
INCOMING CABLE FITTED WITH SHRINKABLE IRRADIATED POLYTHENE TUBING EXTENDING ABOVE COMPOUND LEVEL
21 3/4"
12"
6 1/4"
VIEW WITH LID REMOVED

*Fig. 1. Sealed terminal box with cable connectors and diaphragm pressure-relief vent*

* Paper 3695: "The Design and Performance of High- and Low-voltage Terminal Boxes." Mr Schwarz is with Laurence, Scott and Electromotors Ltd.

can incorporate rubber plugs or cellulose acetate pressure-relieving diaphragms. Both are equally effective.

If the idea of letting some of the hot gases and flame escape from the terminal box in the case of a fault is accepted, the question arises of how to dispose of the gases, etc. The immediate aim is to avoid the condition in which the flame is expelled with an "explosive" pressure of several hundred pounds/sq in. If it does come out under such pressure, there will be severe flame cutting of any normal sheet metal ducting in the way. It is possible by careful placing of vents to avoid this situation, and performance can be improved by fitting an arc chute of metal plates.

Table 1 shows the conclusions from short-circuit tests on terminal boxes designed in accordance with the principles stated above.

During testing under short-circuit conditions, a number of refinements of design have become apparent. For example, rigid insulators supporting cables should be avoided, for they fracture under mechanical stress, and the arc is then drawn to greater length between phases, with increased energy release. The preferred arrangement has the connectors already described clamped between halves of a split Tufnol block (Fig. 1).

If an arc does occur, its effect on the main terminal box structure may be reduced by providing additional metal barriers. Steel is as good a material as any for this. Taping of the conductors proves to have the added value that it will not support an arc.

**Table I. Expected Characteristics, Vented Terminal Boxes**

| Fault level | | | Terminal Box | | | Arc Energy | Prospective Pressure |
|---|---|---|---|---|---|---|---|
| kV | MVA | kA | Vol. cu ft | Connector Spacing in. | Vent area sq in. | % | % |
| 3·3 | 150 | 26·3 | 1·35 | 3½ | 12 | 100 | 100 |
| | 250 | 43·7 | | | 25 | 167 | 167 |
| 6·6 | 350 | 30·7 | 1·55 | 4½ | 25 | 167 | 148 |
| | 500 | 43·7 | | | 35 | 240 | 210 |
| 11 | 500 | 26·2 | 3·9 | 6 | 30 | 200 | 70 |
| | 750 | 39·3 | | | 45 | 300 | 104 |

Much the same precautions as those described above are desirable in designing a terminal box for use at 440 V, except that the lower voltage makes taping of the connections unnecessary. If the motor is protected by fuses, then the cut-off effect of the fuses imposes a useful limit on pressure rise in the terminal box in the event of a fault. It is reckoned that there is small likelihood of external damage occurring in a conventional terminal box of a machine below 50 h.p. rating, provided that it is correctly fused.

Sometimes it is not possible to vent the terminal box into the surrounding atmosphere. An obvious instance is where flameproof gear is required. No full solution to this problem is available although the use of fuses, even for high voltages, holds some hope of success. Venting into the machine itself requires large volumes and does not look promising.

# DISCUSSION

MR L. W. JAMES (CEGB) traced the background to the developments described in the paper. A study made ten years ago showed that there was no history of trouble with 3·3 kV motors, so many hundreds were subsequently installed in power stations. Troubles with terminal boxes became known centrally in 1957. This followed winding failures in relatively small motors. There was consequential failure of the connections between the windings and the cable terminations. The flashover in the terminal boxes that followed caused the cast iron boxes to burst and scatter fragments about the power stations.

When this trouble became known, a survey was made and it was found that in the five years up to January, 1958, 74 failures of motor terminal boxes had occurred in power stations, and about half had resulted in the shattering of the boxes. About 3,600 h.v. motors were at risk. There had been 30 more incidents of this nature up to November, 1960, half of them explosive. Evidence so far suggested that since November, 1960, the rate of failure had been going down. There had been one death and three people injured from such explosions in the last three years.

There seemed no connection between the nature of the supply system and the failure, and failures spread over the whole range of motor sizes. In the boxes that failed, relative cleanliness left much to be desired. Discussions between the CEGB and the appropriate BEAMA groups had led to the specification of a standard 3·3 kV terminal box.

MR D. D. STEPHEN (AEI) said that so far as he knew there had been no similar troubles overseas. This fact suggested that it might be important to see if there was any significant variation in practice, including the method of earthing. It was disturbing to find that some designs of box which did not incorporate the features described by Mr Schwarz seemed trouble-free. One of the main weaknesses seemed to be compounding and the cable crutch. Availability of butyl rubber cables and consequent easing of terminations could alleviate the problem.

MR T. B. ROLLS (McLellan and Partners) said that the volume of flame and smoke issuing from terminal boxes under fault conditions led to concern about flameproof certified equipment. The work on terminal boxes seemed to show that an electrical arcing explosion was far more severe than a gas explosion, which was the basis of FLP testing. This was particularly important with respect to industrial, as distinct from mining, uses of FLP equipment; in the latter cases, quite high fault MVA was possible. One approach to the difficulty might be to have complete phase separation in the terminal box, and neutral resistance earthing.

MR P. HUGGINS (LDC) described the new CEGB terminal box design and said that 14 prototype boxes were being made for proving tests at short-circuit ratings of 250 MVA. Subject to satisfactory tests, similar boxes would be developed for 6·6 kV (500 MVA) and 11 kV (750 MVA). He described essentials of the new design shown in Figs. 2 and 3.

MR T. H. MASON (CEGB) said that when failure of 3·3 kV terminal boxes was first under consideration, it was thought that current chopping was a contributing factor. At two or three stations, cables, motors and boxes were all breaking down at the same time. The stations were equipped with oil-break c.b's of relatively high capacity. Measurements showed that peak voltage could be five times nominal with an o.c.b. and 1·7 times nominal with an air-breaker. It seemed probable that these peak voltages should be considered reasonable. New designs of terminal box ought to withstand these voltages

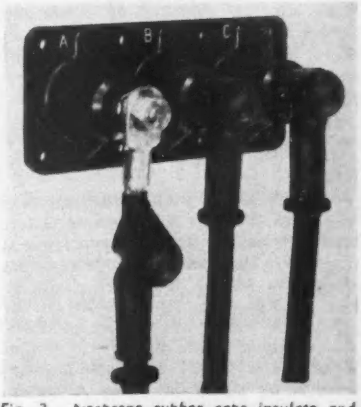



*Fig. 2. Neoprene rubber caps insulate and seal terminals in the CEGB-BEAMA prospective standard 3·3 kV terminal box*

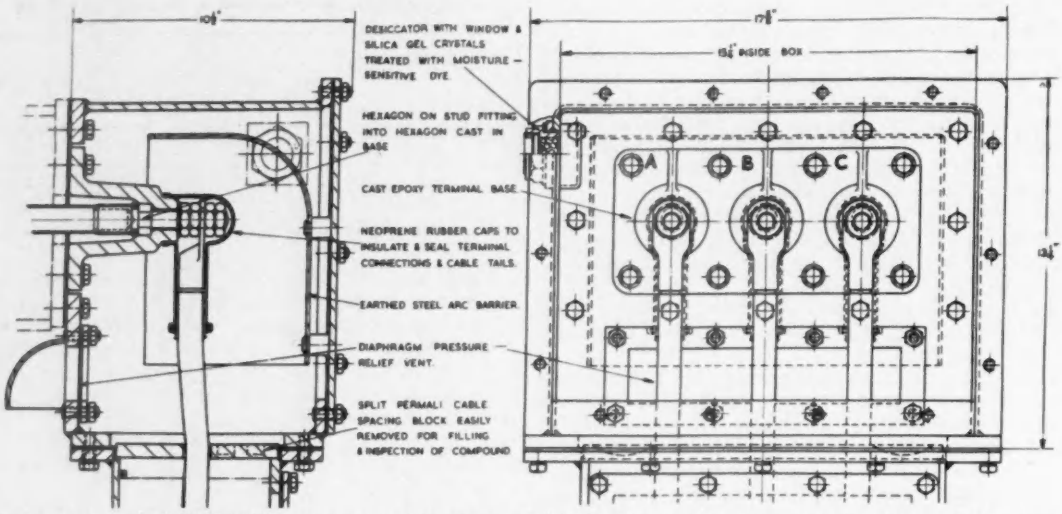

DESICCATOR WITH WINDOW & SILICA GEL CRYSTALS TREATED WITH MOISTURE-SENSITIVE DYE
HEXAGON ON STUD FITTING INTO HEXAGON CAST IN BASE
CAST EPOXY TERMINAL BASE
NEOPRENE RUBBER CAPS TO INSULATE & SEAL TERMINAL CONNECTIONS & CABLE TAILS
EARTHED STEEL ARC BARRIER
DIAPHRAGM PRESSURE-RELIEF VENT
SPLIT PERMALI CABLE SPACING BLOCK EASILY REMOVED FOR FILLING & INSPECTION OF COMPOUND
INSIDE BOX
A
B
C

*Fig. 3. Proposed standard CEGB-BEAMA motor terminal box design for 3·3 kV. There is 2 in. minimum sparking distance between terminals and earth, 4½ in. minimum creepage distance to earth, 8½ in. between terminals. All flanged joints are gasketed with neoprene rubber*

with a good margin. Another approach tried was to fit a resistance-capacitance circuit to cut down the surge voltage level. The voltage was cut to about half, and no breakdowns had occurred on terminal boxes of motors so fitted. An alternative approach to the failure problem might be to dispense with terminal boxes and merely support the leads between the motor frame and normal cable sealing boxes. Another possibility was the compound-filled cable coupler.

MR C. N. DAWSON argued that danger was much reduced if the whole of the termination was immersed in solid compound. It was users' desire to be able to disconnect a motor without breaking down a cable joint that had brought about the situation in which devices like pressure release diaphragms were necessary. He thought that to introduce these was a retrograde step. He would have preferred to have seen a box in which the three phases were separated, with the supply system using neutral earthing of the neutral to restrict fault current. He alleged that the flash, on the evidence of condensed copper vapour, could travel at least 12 ft when a full power fault occurred in a 3·3 kV terminal box fitted with pressure relief devices. Was it right, he asked, to demand a box which could cause this to happen in order to save four or five hours in replacing a faulty motor?

MR B. BARKER (CEGB) thought that ingress of moisture was a major factor, and that making the cable joints was a difficulty. The use of plastics cables seemed to have a lot to offer and so had the use of crimped connectors for cables. He noted that the use of resistance earthing of the neutral was recommended and largely used for auxiliary circuits in power stations. A phase-segregated terminal box had recently been tested, but complete phase segregations could not be obtained unless three single-core cables were used or three-core screened cables.

MR W. FORDHAM COOPER (Factory Inspectorate) said that there was a fatality in 1960 when the terminal box of a 6 kV boiler-feed pump motor blew up and hit a man 14 ft away. He said there had been a "steady stream" of cable boxes on switchgear and transformers blowing up. Many failures were due to bad workmanship. In the designs shown, nothing seemed to have been done about the cable crutch or about joints in compound. Of the designs generally, he said he could not contemplate with equanimity great volumes of smoke and flame shooting round people who were near a faulty terminal box.

MR C. ZAKIEWICZ supported the use of crimped joints as a contribution to the safety of cable boxes. MR W. HILL (AEI) was horrified that the pressure-relief diaphragm was only 5 thousandths to 20 thousandths thick. It was not possible to see when one was damaged, and moisture and dirt could then enter. He stressed the advantage of earthing the neutral through a resistor.

MR J. TOZER noted the remarks about bad workmanship and said that the cause of a lot of trouble was failure to provide the cable jointer with enough room to work in. At 415 V, below 25 h.p., he was finding it almost impossible to get a decent terminal box.

MR J. TITTERINGTON (AEI) said he had personal experience of earlier failures of the type discussed both in British power stations and abroad. He said he had for long advocated phase separation in terminal boxes, and he was using this technique in the department under his control.

MR J. SOLOMON said there had been a collective approach by BEAMA switchgear firms to the circuit-breaker and over-voltage aspect of terminal box failures. Not all circuit-breakers had given high over-voltages.

MR D. A. DEWISON (CEGB) noted that energy was linked to fault current and arcing time. These were dependent on the electrical system. MR W. E. G. ROBINSON (NW Gas Board) remarked that if only manufacturers delivered equipment on time, there would be no need to put pressure on cable jointers to hurry their work.

MR W. F. LOVELY said that too many boxes were too complicated and so had too many joints. The fewer joints there were the better. MR J. R. HARDING was against the use of boxes at all. The cable terminations seemed the Achilles heel and he thought cables were better made off in normal sealing ends.

MR W. J. OUTRAM (UKAEA) said that in a three-phase cable, reliance was being placed on the compound to safeguard against phase faults. Radiography of all high-tension boxes could help to improve the standard of jointing, and it had the advantage of a psychological effect for jointers to do good work.

Replying to the discussion, MR SCHWARZ said that a safe box in the FLP sense could be obtained only by complete phase separation, and very large flanges. He thought manufacturers had to accept that terminal boxes had failed because of bad design.

Referring to the tests on improved boxes, he said it was important to note that in no case was there an explosion, nor did any of the smoke and flame emerge through flanges. Pressure relief by venting into the motor had been suggested, but it was difficult to obtain enough motor volume.

On the suggestion of loose leads from cable ends rather than conventional terminal boxes for connecting motors, Mr Schwarz commented that they offered no real advantage and took up more space.

US practice was to use contactors and fuses for protection up to medium size machines. He thought that if there was interest in using fuses for the protection of h.v. motors in this country, then suitable designs would be produced.

# Progress in European Markets

## PRODUCTIVITY CONFERENCE HEARS CONTINENTAL VIEWS

EUROPEAN markets are dynamic, but if British exporters enter them they must go in to stay, Sir William McFadzean, chairman of BICC, told a British Productivity Council conference on "Producing for European Markets." Europe presents not one but 19 markets, all of them different and every one challenging. There is a tremendous potential in these markets which must be taken advantage of.

One of the chief enemies of British exporters, said Mr B. N. Neuman, a Swedish marketing consultant, is that their goods are considered out-dated by Europeans. Products are recognised as being reliable, but their appearance and design is the worse off for workmanship and solidity. For this reason, British industry is looked on as one based on old traditions with craftsmanship rather than on mass production. An accusation levelled against British exporters by the Swedish is that they fail to put sufficient effort into selling their goods. This image, said Mr Neuman, is not the best one from which to start marketing more and modern British goods abroad. In the first seven months of this year Sweden has increased her British imports by 5%, but at the same time the rate of increase of exports from other EFTA countries is 12%.

A clearer picture of the way Britain is losing ground is given by the comparison of Swedish imports of some consumer goods from Britain and Western Germany over the past ten years:

| *Refrigerators* | *Great Britain* | *W. Germany* |
|---|---|---|
| 1950 | 86% | — |
| 1955 | 22% | 49% |
| 1960 | 6% | 60% |
| *Washing Machines* | | |
| 1950 | 98% | — |
| 1955 | 56% | 31% |
| 1960 | 41% | 43% |

Sweden has a competitive market where only the fittest will survive and only the ones who know how to market a product will be successful. "The one who is successful in the Swedish market has shown such a knowledge of modern marketing practice and he will have all chances to succeed in other European markets."

### Warning to Industry

A warning to industry is given by Sir Keith Joseph, Minister of State, Board of Trade. There are, he alleges, those who say that export margins are slender and home sales are far more profitable. This may be so in some cases, but far more important is the prospect that as tariffs come down—whether we enter the Common Market or not—competition at home will be keener. Profit margins will be cut at home, whereas those abroad, which look slender now, will look much more attractive.

Britain's first five years in the Common Market will be extremely difficult, said Mr Brian Rootes. They will call for drastic readjustments by all sections of our industrial community. If, however, we decide to stay out of the market, far greater and more depressing problems will face Britain. The incentives to go into Europe are exceedingly strong and this country has the technical capacity to compete. The larger plant and equipment in our factories is equal to that of competitors in Germany and France. If we are to succeed, the level of productivity in this country must be far higher. Between the years 1950 and 1958 productivity in Italy increased by 4·5%. In France it was increased by 3·7% whereas the UK increase was only 1·3%. "Obviously, we cannot compete if our costs are higher and our productivity is lower," he said.

### Bad Reputation for Delivery

This country's reputation abroad on the question of delivery promises is disgusting. This is the opinion of Mr J. Hanning, who is managing director of two French companies and chairman of another. British engineering sets a standard of honesty and integrity second to none in every respect, but delivery promises are given in an "airy-fairy" way. It seems obvious, he said, that if we are going to try to build up a permanent connection with leading European firms it is essential to bring a complete change of mind regarding this important point of accurate delivery dates. "In my opinion, unless the managing director realises that delivery of equipment at the promised dates is as important as delivery of the money to pay for it you will not succeed."

Mr Hanning condemns the manner in which some firms treat delivery dates and quotes an instance of top management regarding three months late on a ten-month delivery as being "not too bad." Agents have an appalling job in explaining away late deliveries to irate customers, who are then inclined to build minor technical snags to difficulties of great magnitude.

Serious consideration needs to be given, immediately after an order has been obtained, to the difficulties clients are likely to be faced with, owing to differences between British and continental standards. It is therefore advisable, soon after an order has been placed, to submit to the customer proposals for special tools and spare parts which are likely to be difficult to obtain locally.

If Britain joins the Common Market, Mr Hanning sees no reason why we should not get a fair share of the trade. It must be remembered, however, that this country has lost a good deal of ground because of failure to join the European Steel Pool. This has led to closer Franco-German relations, on top of which American aid has succeeded in making continental manufacturers believe that American equipment leads the world.

When exporting capital goods to Europe, Mr Hanning advises that efforts should be concentrated on goods which show some marked technical advance in the home market. This is far better than entering into direct competition with well-established local firms who naturally command a good deal of favour based partially on national consideration but mainly on well-established goodwill.

# "Tracking" in insulation

## NEW LIGHT ON KNOWN BREAKDOWN PHENOMENA

THE subject of "tracking" is an evergreen one for discussion among engineers engaged on insulation problems, both in the general sense of surface carbonisation, which can result from contamination by dirt and moisture on all insulating materials in service, and also in the specialised sense related to certain synthetic resin-based materials, notably those containing phenolic resins. It is more than 40 years since the first attempts to investigate the phenomena were organised and several generations of young scientists have given a large part of their time to its study without—let us be honest—making very much progress. The Electrical Research Association is among the foremost of the bodies who have endeavoured to unravel the mysteries of tracking and have published the results of their investigators' work on a number of occasions.

On Tuesday, 14 November, one of the Association's younger investigators, Mr N. Parkman, gave an informal lecture before the Measurement and Control Section of the IEE in London, in which he described his own approach to the subject and some of the observations and conclusions he had made.

To commence with, he had circulated industry with a request for information on known cases of tracking with details of the material involved, service voltage and other pertinent particulars. Not surprisingly, an appreciable number had "never heard of it," while several others admitted that they had heard of its occurrence "but not with our insulating materials." There was, however, a balance of reported cases with several materials and service voltages down to 230 V which he had been able to summarise and from which it was evident that the largest number of occurrences were at lower voltages and mainly with moulded phenolic insulation.

Like many investigators before him, Mr Parkman had formed the conclusion that tracking was largely a surface phenomena which occurred as the result of stressed insulation becoming contaminated by dirt and/or moisture. The flashover across the conducting path so formed usually dispersed the contaminant but resulted in partial carbonisation of the insulating material, particularly when it was chemically a carbon-rich organic substance.

### Epoxy Resin and U.V. Light

As an alternative to ceramic insulation, certain insulators fabricated from epoxy-resin bonded glass-fibre had been subjected to high dielectric stress for a long period in the open air and subject to all the vagaries of the English climate. The first observation to be made was that tracks or "trees" started to form on the surface of the insulation, which tended to rise from the earthed base but invariably occurred first on the side exposed to the sun. This deterioration was attributed to the effect of u.v. light, and several palliatives were tried. The covering of the surface by a polythene bag which excluded the u.v. light was unsatisfactory because it gave rise to condensation within and so caused tracking from an even worse condition. Another device was to varnish the surface with a synthetic resin coating known to absorb u.v. light. In another insulator, a pierced barrier supporting busbars, tracking was noticed from the corners. In each case it was obvious that the distribution of electric stress was not even over the surface, and one of the lessons to be learned with all insulator design was to plan the spacing and material distribution to suit the conditions in regard to stress such as would be disclosed by stress distribution patterns obtained on prototypes in an electrolytic tank.

### A.C. and D.C. Breakdown

Another point which had been investigated was the appreciable difference in breakdown or tracking voltage on a.c. and d.c. when using the ERA tracking apparatus. The d.c. breakdown was a great deal higher than the a.c. breakdown but it was accidentally discovered that, after a short period of stress at d.c. slightly below the estimated breakdown voltage, reversal of the polarity would result in an immediate failure at a substantially lower voltage. This observation gave rise to a further investigation in which the behaviour of the electrodes on the surface of a test piece under a film of ammonium chloride or sodium chloride contaminated water was examined. It was discovered that, after polarity reversal, a tree-like growth of copper developed on the cathode, rapidly spreading across the gap and giving rise to an arc which carbonised the surface of the insulation and caused its breakdown. This phenomena was vividly demonstrated on a number of coloured film extracts.

Mr Parkman also showed by charts and graphs other general conclusions he had reached in the light of both observed and reported failures in service. Among the materials most prone to tracking were the phenolic resins and polycarbonates. An important point was that, with phenolics, a voltage which produced tracking was independent of the distance between the electrodes whereas, with other materials, tracking voltage was a function of the distance between electrodes. It was therefore obvious that one could not cure a case of tracking in phenolic insulation merely by increasing the surface flashover distance by barriers or similar features. A fresh approach to stress distribution was essential.

### Discussion

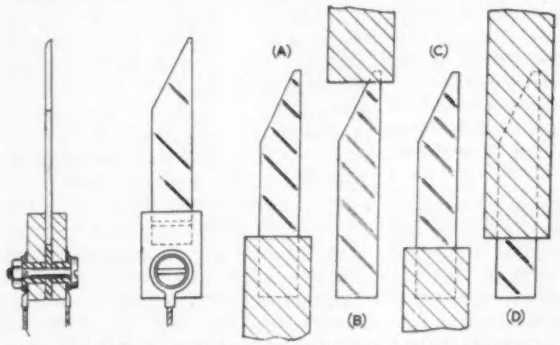
In the short discussion after the lecture, Mr J. R. Ferguson described some of the design problems associated with hot-cast epoxy-resin insulators. He showed a sample pole line insulator and demonstrated how the arrangement of the sheds varied from that of a ceramic type to suit the different stressing. He emphasised the importance of stress control, to which Mr Parkman had referred, and also suggested that the tendency of the epoxy-resins to "track" might well be due to phenolic inclusions. He thought that there was a big future for epoxy-bonded glass-fibre insulators, many of which had been in service for some years on the continental railway systems. But they must be cleaned at regular intervals.

# PROGRESS IN PATENTS

SELECTED SPECIFICATIONS

## Novel Sensitive Thermocouple

Two ways of increasing the sensitivity of a thermocouple are: (a) to reduce the mass of the hot junction; and (b) to increase the number of hot and cold junctions in series. Both methods are employed in a novel design described in Specification 881,622 in the name of the National Research Development Corporation of Tilney Street, London. The device is in the form of a thin blade tapered at the tip to form a hot junction of low thermal




*Design and constructional method for a low thermal capacity couple*

mass and capacity. The blade comprises a thin glass probe upon which are deposited alternating thin films of suitable metals interposed by equally thin films of insulating material, the metals being applied preferably by vapour deposition techniques.

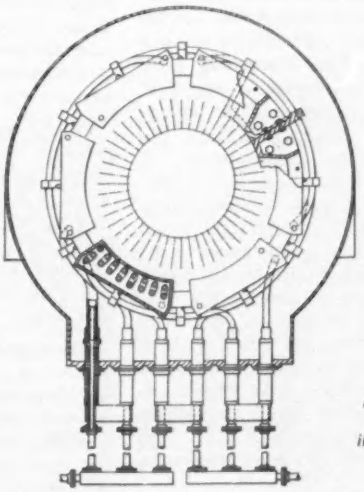
The method involves the deposition in stages on areas exposed by selective masking. At (D) the blade is masked for depositing a metal film, such as aluminium, to form one terminal element, being carried round to the opposite side for contact with a terminal screw. At (C) the blade is masked for vapour deposition of a film of antimony or other thermocouple metal; at (B) it is masked for an insulating film; at (C) it is masked for deposition of the second thermocouple metal film, such as bismuth, after which the mask is adjusted to (A) for another insulating film leaving an area exposed at the base for a cold junction with the next metal film. Succeeding films are deposited in sequence—BCACBCAC—until the stack is of the desired thickness ready for a final terminal film of aluminium. A suitable insulating film is antimony trisulphide and the terminal clamp may be of the form shown.

## Plates for Storage Batteries

Longer life for the positive plates of storage batteries is the aim of Specification 881,600, granted to the German firm Accumulatorenfabrik Sonnenschein G.m.b.H. of Budingen. Its essential feature is the provision of a braided plastics stocking to cover a rod-like electrode, the braiding being made of plastics material. Unlike some other suggestions along the same lines, the braiding has straight longitudinal filaments woven in, as well as inter-crossing helical filaments. This longitudinal element is claimed to lessen the risk that the braiding will contract along the length of the electrode and permit part of the active material to fall off under the effects of vibration and the like. The plastics material chosen has to be strong but elastic to accommodate changes in the cross-section of the electrode. It is suggested that suitable materials are low-pressure polypropylene and low-pressure polyethylene. At each end of the sheathing, unravelling can be prevented by welding the component parts of the sheath together.

## Stator Liquid Cooling

Construction of stator liquid cooling connections for an alternator is described in Specification 881,908 of C. A. Parsons. It makes use of boxes made of electrical insulating material as infeeds for the coolant. In the form illustrated, cast epoxy resin boxes are supported by cast epoxy resin brackets, which also support the main conductors. The shape of the boxes in plan can be seen on the illustration, one of which has the cover removed. Connections for the coolant are made through a hollow insulating unit which passes through a bushing. The coolant passes through a conductor to the other end of the stator, where it enters another box. It is a feature of the design



*Liquid cooling arrangements for a large stator incorporate epoxy resin coolant infeeds*

that two entries are provided for each box, one of them being plugged in any particular application. The other entry is used to admit the hollow conductor which constitutes the phase or earth connection for all the conductors terminating in that particular box. Links within the box connect the conductors in series electrically while leaving their ends open to allow the liquid to enter. Brackets already mentioned are arranged at the stator end to form a conical ring located by the stator end plate. End-winding fixing is thus facilitated.

Reproduced by permission of the Controller of H.M. Stationery Office. Copies of specifications may be obtained from the Patent Office (Sales Branch), 25 Southampton Bldgs, W.C.2. Price 3s 6d.

# Personalities *in the industry*

*Mr A. I. Mackenzie*

*Mr R. G. Riddle*

*Mr K. J. Coleman*

*Mr C. R. Garnett*

*Mr E. H. Cox*

A part-time member of the North of Scotland Hydro-Electric Board for the past ten years, **Mr A. I. Mackenzie,** B.A., C.A., has been appointed deputy chairman of the Board as from 1 Jan. next. He will succeed **Sir John Erskine,** G.B.E., D.L., J.P., who is retiring after one year in that office and as a member of the Board since 1948. In addition, **Mr A. A. Fulton,** C.B.E., F.R.S.E., B.SC., M.I.C.E., M.I.MECH.E., who has been general manager since 1955, is also to be a member of the Board. In a further change, **Sir George McGlashan,** C.B.E., J.P., is also to retire, after 13½ years on the Board and as chairman of the North of Scotland Electricity Consultative Council. He will be succeeded in both appointments as from 1 Jan. next by **Lord Macdonald,** Lord Lieutenant of Inverness-shire, who is at present deputy chairman of the consultative council (*ESH, page 171). Mr Mackenzie, whose appointment as deputy chairman is for a period of three years, is also a director of Metal Industries Ltd. Prior to 1955 Mr Fulton was chief hydraulic and civil engineer to the Board from 1944. Earlier he was engineer and manager of the Dundee Corporation Water Department, after three years with Boving and Co. Ltd. It is also announced by the Secretary of State for Scotland that **Provost A. Macrae,** C.B.E., and **Mr I. A. Duncan Millar,** M.C., M.A., A.M.I.C.E., J.P., have been reappointed part-time members of the Board.

**Mr R. G. Riddle,** B.SC.(ENG.), A.M.I.E.E., has been appointed assistant manager of the Small Industrial Machines Engineering Dept., in the Birmingham works of the AEI Motor and Control Gear Division. Since January last he has been assistant manager, FHP Machines Engineering Department, and for the past 12 years has been concerned with all aspects of design of AEI light-power machines. He started at the BTH Rugby works in 1940 on a five-year apprenticeship, and in 1944 gained a London University external B.Sc. engineering degree, with second-class honours. On completing his apprenticeship, Mr Riddle joined the A.C. Engineering Department on the mechanical design of high-speed motors. Four years later he was transferred to the FHP Motor Section of the Motor Engineering Department as it was then known.

**Mr K. J. Coleman,** B.SC.(ENG.), A.M.I.MECH.E., A.M.I.E.E., A.F.R.AE.S., has joined Ketay Ltd.—a member of the Plessey group—as chief engineer. He was previously head of control and instrumentation of the Atomic Energy Department of Babcock and Wilcox Ltd. Earlier he was with De Havilland Propellers Ltd. as senior development engineer and head of the Alternator Development Department.

Having resigned from the position of president of International Power and Engineering Consultants Ltd. (ELECTRICAL TIMES, 9 Nov. issue), **Dr Thomas Ingledow** has become president of the British Columbia consulting engineer concern of Ingledow Kidd and Associates Ltd., of which **Mr K. H. Kidd** is executive vice-president.

The appointment of **Mr C. R. Garnett,** B.SC.(ENG.), A.M.I.MECH.E., A.M.I.E.E., as the first station superintendent at the Sizewell nuclear power station of the CEGB, to which we exclusively referred last week, takes effect from this month. But Mr Garnett will not be taking up duties at the station until about May, 1963, and in the meantime will spend some time with the nuclear operations engineer at the Board headquarters, and at Calder Hall nuclear power station of the UKAEA. Since January, 1960, Mr Garnett has been operation services engineer in the CEGB's Nuclear Operations Branch and, earlier, was station superintendent at Stella North power station for over five years. Educated and trained at Lincoln Technical College and University College, Nottingham, Mr Garnett joined the North Eastern Electric Supply Co. in 1946, after war service in the RNVR. He was at Carville and Dunston "A" power stations before joining the staff of the North Eastern Division of the BEA. Following a period at Dunston "B," he was senior assistant engineer to the chief generation engineer (operation) and in that capacity was closely concerned with the design of the Stella power stations.

At present a vice-chairman, **Lord Plowden,** K.B.E., is to succeed **Sir Ivan Stedeford** as executive chairman of Tube Investments Ltd. on 1 Jan., 1963. Sir Ivan will then become the first life president of the company, and serve as a non-executive director. He had intended to retire next January, when he will be 65 years of age, but has agreed, at the request of the directors, to continue until the end of 1962.

Assistant chief engineer (operations and communications) to the Midlands Electricity Board for the past four years, **Mr E. H. Cox,** M.I.E.E., has now been appointed assistant chief engineer (distribution) to that Board (*ESH, page 121). Earlier he was senior assistant engineer (operations and communications) for six years. Educated at Handsworth Technical College and Birmingham Central Technical College, Mr Cox served on the engineering staff of Birmingham Corporation Electricity Supply Department as district assistant engineer and control room engineer before the war, in which he served as flotilla electrical officer in the Royal Navy. Returning to the Birmingham undertaking he was assistant engineer in the distribution department and personal assistant to the deputy chief engineer and manager. When the MEB was established in 1948 he joined the Board headquarters engineering staff as principal assistant (technical and planning). Mr Cox is a member

**Denotes revision to the "Electricity Supply Handbook, 1961."*

of the Administrative Staff College and a member of the Joint Radio Committee of the Nationalised Fuel and Power Industries. In 1959 he visited the USA under the auspices of this committee and in October, 1960, as joint author with Mr R. E. Martin, he gained a premium for an IEE paper on "Radio Communications in the Power Industry." He is also a member of the Chief Engineers' Conference measurement and communications committee and vice-chairman of the South Midland Centre of the IEE, being a past hon secretary of that Centre.

To succeed Mr E. H. Cox, the Midlands Electricity Board have promoted **Mr N. C. Heathcock,** B.SC., A.M.I.E.E., as assistant chief engineer (operations and communications), as from 1 Dec. Since February, 1957, Mr Heathcock has been deputy area engineer in the Board's Worcestershire area (*ESH, page 121). He joined the engineering staff of the Midland Electric Corporation for Power Distribution Ltd. in 1946 and was appointed district engineer at Old Hill in the following year. When the MEB was formed he became district engineer at Stourbridge, and in 1950 joined the chief engineer's department as third assistant engineer (technical). In 1952 he moved to the Worcestershire area engineering staff and has served there as second assistant engineer (operations), senior assistant engineer (planning, operations and technical) prior to becoming deputy area engineer in 1957.

Previously with Nettle Accessories Ltd. and Thorn Electrical Industries Ltd., **Mr N. E. Wilkinson** has joined the northern branch of Dimplex Ltd.

Following our note last week on the new appointments with the Yorkshire Electricity Board we are now able to reproduce below the portraits of **Mr H. Pickup,** B.SC.(TECH.), M.I.E.E., who becomes manager of No. 2 sub-area; **Mr J. S. Yates,** M.I.E.E., A.M.B.I.M., who is the new manager for No. 5 sub-area; **Mr G. L. Tomlinson,** A.M.I.E.E., who is promoted to manager of No. 7 sub-area; and **Mr E. Cockroft,** A.M.I.E.E., who is to be sub-area engineer for No. 5 sub-area.

The British Iron and Steel Research Association has appointed **Mr A. G. Shakespeare,** M.A.(CANTAB.), as head of its steelmaking laboratories at the Sheffield research station. Previously he was in charge of the Association's work on hot strip processing at the Sketty Hall laboratories in Swansea. At one time Mr Shakespeare was at the Nelson Research laboratories of the English Electric Co. where his special interests were X-ray crystallography and the high temperature "cermet" materials. In 1954 he joined BISRA and has since been engaged in research into the design and operation of strip processing plants.

An engraved gold wrist-watch was last week presented to **Mr D. Scott,** one of the southern area sales engineers of Benjamin Electric Ltd., as the company's award of merit for sales engineers for 1960-61.

The Plessey Co. Ltd. announce the appointment of **Mr R. Hall** as divisional general manager of four divisions and associate companies within the Plessey Swindon group. These comprise the Units and Parts Division and Sheet Metal Unit of Plesseys as well as Power Auxiliaries Ltd. and Machine Products Ltd. Mr Hall was previously commercial executive for the Swindon region.

Consultant for the Engineering Department at the Wythenshawe works of the AEI Transformer Division, **Mr H. Diggle,** B.SC., M.I.E.E., has retired after 46 years' service. He has been associated with work on transformers since 1916, initially with the British Westinghouse Co. He was subsequently put in charge of transformer engineering development and, from 1927 onwards, devoted much of his time to the development of on-load tap changers. For many years he was a member of BSI and BEAMA committees, including those for flameproof enclosures and h.v. bushings. Since June, 1960, he has been consultant to AEI. He is also a governor of Bolton Technical College, and hon secretary of the IEE North Western Centre. Mr Diggle was taken seriously ill in June of this year, but his many friends will be glad to hear that he is well on the road to complete recovery. To mark his retirement, Mr Diggle was presented with a slide projector and screen from his colleagues and the AEI Manchester Long Service Association.

After 51 years' service, **Mr J. E. Jordan** has retired from the Purchasing Department of AEI Manchester, at Trafford Pk.

Awards of grants by the Paul Instrument Fund Committee have been made as follows: £44,500, with the possibility of an increase to £52,000, to **Dr V. E. Cosslett,** university lecturer in physics, University of Cambridge, to design and construct a very high-voltage electron microscope and to explore its applications in biological research; £1,000, in supplement of a previous grant, to **Prof D. Gabor,** F.R.S., professor of applied electron physics at the Imperial College in the University of London, and **Dr D. Jones,** for work on the development of an electron interference microscope; £3,500 to **Mr D. W. Hill,** research department of anaesthetics, Royal College of Surgeons of England, for the construction of an infra-red gas or vapour analyser using interference filters; £2,500 to **Dr N. Kurti,** F.R.S., reader in physics and senior research fellow, Brasenose College, Oxford, for the construction of a nuclear thermometer for use in the microdegree Kelvin temperature range; £1,500, in supplement of a previous grant, to **Dr J. H. Sanders,** university lecturer and demonstrator in physics, Clarendon Laboratory, Oxford, for the construction of an optical maser.

**Dr D. L. Oldroyd** has joined Ampex Electronics Ltd. as head of their Research Division, and will direct research programmes in data storage and retrieval in co-operation with the Research and Advanced Technology Division of Ampex Corporation of California. Before taking up his new appointment, Dr Oldroyd served for two years as a physicist with the UKAEA, following 3½ years in a similar capacity with CERN, the European Organisation for Nuclear Research, in Geneva. After graduating from the University of Glasgow in 1945 with a B.Sc. degree in physics, Dr Oldroyd joined the British Post Office En-

Mr R. Hall

Mr H. Pickup

Mr J. S. Yates

Mr G. L. Tomlinson

Mr E. Cockroft

*At the recent ETCTA Ladies' Night, the president, Mr J. D. Lake, is seen on the left with Mrs Lake, and Mr D. N. Hyde, chairman, and Mrs Hyde*

gineering Research Station at Dollis Hill in the following year. During World War II he participated in development work on radar at the Telecommunications Research Establishment of the Ministry of Aircraft Production. In 1948 Dr Oldroyd returned to the Physics Department of the University of Glasgow as a research student and Fellow. He obtained his Ph.D. degree there before leaving in 1955 to join CERN. He is the author of a number of technical papers in the particle accelerator, nucleonic instrumentation and nuclear reactor fields.

**Mr L. H. Brueton** has been appointed export sales manager of "Servis" domestic appliances. He has previously held the positions of sales promotion manager and assistant sales manager for the "Servis" Home Sales Division.

The Minister of Power has reappointed eight part-time members with six electricity boards. They are: **Mr J. Ryan,** C.B.E., M.C., M.A., B.SC., with the Southern Board; **Mr J. A. MacKerrell,** F.S.A.A., **Mr W. H. Stokes,** C.B.E., J.P., and **Alderman E. A. C. Woodcock** with the East Midlands Board; **Mr Basil Curran,** C.B.E., with the South Wales Board; **Mr J. Tristram Beresford** with the South Western Board; **Mr C. C. Hill,** B.SC.(ENG.), M.I.E.E., M.I.MECH.E., with the Eastern Board, and **Mr J. A. Duncan,** J.P., B.SC., with the Merseyside and North Wales Board.

Latterly with J. Walton Electrical Ltd., Manchester wholesalers, **Mr D. Sinyard** has joined Ekco Heating and Electrical Ltd. as sales representative for Lancashire, Cheshire and North Wales.

The Westrex Co. Ltd. have appointed **Com F. Holmes** acting managing director during the absence of **Mr H. L. Marsterton** due to sickness.

Secretary of the Ayrshire area of the South of Scotland Electricity Board for the past six years, **Mr T. F. C. Walker,** B.L., B.SC.(ECON.), A.C.I.S., has been appointed secretary of the Birmingham area of the Midlands Electricity Board as from 11 Dec. in succession to **Mr A. Webb,** F.C.I.S., who recently retired (*ESH, pages 125, 165). Mr Walker joined the South West Scotland Electricity Board in 1948 as principal assistant (administrative) in the secretary's department at headquarters, and in 1953 became secretary of the Dumfries and Galloway area. Earlier he had been personal assistant to the secretary of the Scottish Engineering Employers' Association for three years.

**Mr C. R. Wheeler,** who joined Associated Electrical Industries Ltd. in August, 1960, as a vice-chairman, is to become deputy chairman as from 1 Jan., 1962. He will also be deputy chairman of the AEI Management companies. In certain City quarters it is suggested that this change seems to indicate that Mr Wheeler, who is 57 years of age, may well succeed Lord Chandos as chairman when the latter, who is 70 next year, decides to retire. eBfore joining AEI last year Mr Wheeler, was chairman of Guest, Keen, Iron and Steel Co. Ltd., and the director of several steel and allied companies. He remains a director of Guest, Keen and Nettlefolds. He was president of the Iron and Steel Institution in 1958-59 and is this year's president of the British Iron and Steel Federation.

**Mr E. V. Small,** at one time joint managing director of AEI, and now a consultant to that company, has joined the board of Blaw Knox Chemical Engineering Co. Ltd. He joined the board of Blaw Knox Ltd. in December, 1960, and recently became chairman of the board of Boving and Co. Ltd.

Chairman of the Midlands Electricity Board, **Mr W. S. Lewis,** C.B.E., J.P., who is retiring at the end of the years, was guest of honour at a luncheon arranged by the Midlands Electricity Consultative Council last Monday. The chairman of the Council, Ald the Rev R. A. Giles, presented Mr Lewis with a set of gold cuff-links in appreciation of what he has done for consumers during his 14 years as MEB chairman. He also received a carved three-legged milking stool from Mr J. S. Billington, on behalf of Staffordshire farmers.

**Mr B. Pringle,** M.B.E., consultant and manager, Industrial Applications Engineering Department, AEI Motor and Control Gear Division, has retired after 47 years' service with the company. During his career he has done considerable work on standardisation of electric motors and has taken a leading part in similar work on Admiralty aircraft and BEAMA committees, also with the BSI and on IEC.

## OBITUARY

**Mr W. F. Kearsley,** A.M.I.E.E., of Caterham, died on 13 Nov., aged 77.

**Mr J. Forrester,** A.M.I.C.E., A.M.I.MECH.E., who was at one time with the London Power Co., died at Christchurch, New Zealand, on 1 Nov.

**Sir Harry Harrison Burn,** K.B.E., chairman of Calcutta Electric Supply Corporation Ltd., died on 19 Nov., aged 73.

**Mr C. W. Poole,** commercial officer of the Fens sub-area of the Eastern Electricity Board since March, 1960, died on 18 Nov., aged 58 (*ESH, page 108). He entered the electricity supply industry as an apprentice with the Bury St. Edmunds' undertaking and joined the East Anglian Electricity Supply Co. as commercial assistant in 1931. Three years later he became sales engineer for the Norfolk area and later served with the Beds, Cambs, and Hunts Electricity Co. When the industry was nationalised he joined the commercial staff of the Eastern Board, being engaged on rural development, initially as commercial assistant, and from 1949 as senior assistant engineer.

**Mr D. V. Onslow,** A.M.I.E.E., information officer to the Electrical Research Association until 1959, died on 17 Nov., aged 76. Educated at Cheltenham College and Christ's College, Cambridge, he was subsequently awarded a first-class certificate in electrical engineering by the City and Guilds Engineering College. After serving with the Metropolitan Railway and Marconi's Wireless Telegraph Co., he was appointed assistant manager of Gallottis Wireless Telegraph and Telephone Co. Ltd. During the first world war he was occupied with the design and manufacture of wireless telegraph apparatus for the Admiralty by Creed and Co., Croydon. In 1921 he joined the Electrical Research Association as one of its first technical committee secretaries and was responsible for a wide range of subjects. During this period, in collaboration with the late Mr E. B. Wedmore, he compiled an electrical engineers' data book. He became information officer for the ERA in 1938, a post he held until 1959 when he took up part-time duties as the first editor of *Co-operative Electrical Research*, the journal of the ERA.

# Testing without destruction

## MORE PAPERS FROM THE RECENT I.E.E. SYMPOSIUM

AMONG papers presented at the IEE symposium on Non-destructive Testing was a treatise[1] on xeroradiography as applied to the examination of electrical components for the detection of flaws, cracks and voids in insulation by Dr A. Nemet. Xeroradiography is a radiographic inspection technique in which the film is replaced by an electrically charged selenium layer. Exposed and developed by spraying the plate with a fine powder in the conventional way, an image is formed by the electrostatic attraction of the powder particles, which can be visually examined or even photographed if a permanent record is required. The method gives more enhanced contrast at flaws and section changes than with ordinary radiography and the cost is said to be much lower. Dr Nemet described the methods whereby the technique was used as a tool in design and also in the detection of faults in equipment and/or components.

A paper[2] by A. M. Adams, G. W. Smith, R. C. Stanley and P. W. Teare on X-ray and electron microscopical methods of examination gave particular emphasis to X-ray diffraction techniques which have been in use at the CERL over the past nine years. Originally used to identify corrosion products and contaminants, they have more recently been applied to the study of grain-oriented steels to determine the distribution and orientation of individual grains in both coarse- and fine-grained specimens. This has been done in an attempt to relate magnetic properties to textures developed during rolling and heat-treatment.

Electron microscopy has received an impetus in metallurgical research by new techniques of specimen preparation. One method is by carbon extraction replication, a technique devised by Smith and Nutting, which is of particular value in the study of austenitic steels for electrical machines. The second is a thin film microscopy technique developed at Cambridge over the past five years which is invaluable in identifying dislocations, precipitates, etc., on time-stressed components such as superheater tubes after many years in service. Moreover, many of the examinations may be made *in situ*. X-ray spectroscopy has also been used in metallurgical studies of corrosion and fatigue, growth of oxide films, etc.

Radiographic studies of polythene insulation in submarine cables have also been of assistance in evaluating the quality of moulded joints. Methods by which it is applied were detailed in the paper[3] by D. C. Shotton, while R. Taylor[4] described how X-rays can be used to reveal internal features of electrical components and to disclose faults in manufacture without harming them.

### Nucleonic Gauging

A fresh approach to the monitoring of thickness in metal and dielectric films used in capacitor manufacture was outlined by P. W. Boyle.[5] A radioactive source of thallium 204 or strontium 90 is mounted in a container closed at one end by a radiation-absorbing shutter. This end is presented at one side of a gap, on the facing side of which is a detector, usually a sealed ionisation chamber filled with air, krypton or xenon.

When the shutter is opened, the electrons emitted by the source impinge on the detector unless they are intercepted by the film between, in which case the degree of interception will depend upon the thickness of the film and its material. Maximum and minimum readings for calibration are determined without any film in the gap and with the shutter open and closed, while the signal from the detector, of the order of $10^{-9}$A applied to a resistance of $10^{10}$ ohms, is amplified and applied either to an indicator or an automatic control device.

In an alternative application, nucleonic gauging of films on metal surfaces can be monitored by a backscatter technique and it was claimed that the production tolerances possible by the method are much finer than with other conventional methods.

The use of microwaves, projected through suitable wave-guides, for monitoring the profile of rotating bodies is another technique described by P. B. Barber and J. S. T. Looms.[6] Here a klystron oscillator is used to "illuminate" the rotating element through a wave-guide which incorporates a tee-junction leading to a detector crystal. It was said that, though qualitative changes are readily detectable—even on quite complex shapes—quantitative measurements of variations are limited to simple cylindrical or planar forms. The method, however, may be considerably improved as and when sources of waves shorter than 8 mm become available.

### Over-voltage Tests

It may come as an unpleasant shock to many who place their faith in the over-voltage proof test on insulation to hear that, in the opinion of J. H. Mason, the traditional a.c. test gives no assurance against breakdown in service through electrochemical deterioration or by subsequent electric discharges well below the test voltage. In his paper,[7] Dr Mason summarised the known mechanisms of failure and the significance of discharges on d.c. and a.c. high voltages, and dealt with the contributory qualities which determine the breakdown voltage in an insulating material. These include specific heat of the material, thermal conductivity and consequent rate of thermal dissipation (which is also a function of the shape of the component), insulation resistance and dielectric losses, both of which are variables with temperature. These factors differ so greatly between various insulating materials that there is no logical justification for dependence on a general a.c. test. In common with many to whom this is no new argument, Dr Mason placed more faith on design to figures determined by breakdown tests, supplemented by discharge detection and dielectric loss measurements on the finished product, before passing for use in service.

On the subject of impulse voltage acceptance tests as applied to transformers, electrical machines, cables and

capacitors, E. L. White[8] issued the warning that, though they are, by assumption, non-destructive when successful, it is not easy in practice to establish the criteria of insulation failure and to co-ordinate them with observations. On cables and capacitors, impulse acceptance tests are still considered impracticable while similar tests on transformers and machines may not discriminate between faults and partial discharges and, indeed, in the case of motors and generators, are ineffective through the variable behaviour of the magnetic circuits under impulsed test voltages.

## Insulation Serviceability

The assessment of insulation serviceability for a particular application was also the subject of other papers. K. H. Stark,[9] dealing with turbo-generator stators and high-voltage bushings, asserted that deterioration of insulation in service can be followed by non-destructive tests and placed his faith in the detection of discharges. F. C. Walmsley[10] surveyed the requirements for and methods of test applied to s.r.b.p. laminates specifically for insulation service and made a number of pertinent comments on methods which had been advocated in other papers. Radiographic examination of bushings is difficult to justify on economic grounds, particularly as many weigh up to half a ton. Though it has proved invaluable in maintaining quality to date, the aural "hissing" discharge test needs replacing by one which is more objective. In so far as laminates are concerned, the major problem is to assess the qualities in a plane parallel to the laminae without extracting specimens. E. C. Salthouse and D. S. McIlhagger[11] reminded us that no significant changes had taken place over the past 40 years in the methods for determining surface resistivity, and it was already widely known that the methods were inaccurate in that they did not eliminate the factor due to shunt resistance paths through the material in the vicinity.

## Production Control

A paper[12] by W. L. Town summarised the various methods whereby the production of cable was monitored and controlled in regard to capacitance, eccentricity and diameter gauge, with particular reference to extruded plastics-insulated types. Economic considerations demand that such cables shall be made to close tolerances and, in the monitoring devices so far developed, resolutions of the order of 0·0001 in. are often obtained. He reviewed the different forms of gauge and compared the advantages and disadvantages of the various systems, both as monitor recorders and elements of automatic control systems for long production runs.

R. O. Jenkins[13] also dealt with production control problems in his paper on the testing of sealed-off vacuum devices for leaks during manufacture. Two classes of method are used; the non-specific, involving the measurement of differences in total gas pressure with time, and the specific, using such devices as halogen detectors, mass spectrometers, etc.

## Corrosion on Conductors

D. W. Vaughan's paper[14] analysed the mechanisms of corrosion experienced on steel-cored aluminium conductors in the UK. The most common is an acidic attack but, in marine locations, a second form, caused by electrolytic action between the steel core and its galvanising in the presence of sea salt, is also experienced. Both forms give rise to bulges and eventual failure of the conductor and cannot be observed from the ground until it has progressed too far for safety. He described the design and method of use of a bulge detector for 132 kV lines.

Another form of corrosion of wider implication is that which appears as surface films on contact metals. Here the danger is that the film will be of high resistance and so prevent the passage of current when the contacts are closed. A study of the effects of environment on the mechanical and electrical properties of surface films was the subject of a paper[15] by A. Fairweather and five associates who collaborated with him in the design and construction of a machine, "MASSACRE" for automatically sampling contact resistance at random points on a metal contact surface.

A final note on the subject of vibration was a paper by C. M. Brownsey[16] on the subject of materials for damping vibration transmitted by machinery and electrical equipment. He described a machine for determining the static and dynamic properties of resilient materials in the frequency range 50 c/s to 1,000 c/s and a simple method for determining the attenuation to be expected by various sheet materials.

In the paper by R. C. Mildner referred to on page 725 last week, it has been pointed out that most of the work detailed in the paper was carried out in the UK.

## Discussions

Inevitably, on such occasions, discussion was cursory and limited by the fact that no preview of the papers had been possible. On the subject of cable joints, Mr F. G. McDonald suggested that not enough study had been made of the mechanical forces which came into play with changes of temperature. A rigid conductor of 0·2 sq in. c.s.a. cycled between −4°C and +12°C would experience changes of load between 2 cwt tensile and 6 cwt compression; moreover, a short-circuit could raise the temperature to 100°C in a fraction of a second. Mr J. K. Maynard criticised references to joint life of 10 years to 20 years; 60 years to 80 years was more realistic. Mr K. H. Hope said that s.c.a. conductors in coastal areas were still in service after 30 years and he felt that, with greased cores and careful making, marine corrosion was not a real problem. Mr L. Roullier supported this contention. Mr Morgan, referring to papers on conductor dancing, said that serious trouble of this sort had been experienced on the Severn crossing. A mode in which the whole loop was moving up and down over peak amplitudes of 35 ft had been recorded. On the subject of discharge testing, Mr C. T. W. Sutton asked if the time was not ripe for an international specification for plastics cables. Messrs Endacott and Mildner replied in the negative.

### REFERENCES


1. "Xeroradiography Applied to the Inspection of Electrical Equipment."
2. "Application of X-ray Analysis and Electron Microscopy to the Examination of Materials in the Electrical Supply Industry."
3. "Radiography of Polythene in Submarine Cables."
4. X-radiography of Electrical Components."
5. "Measurement and Control of Electrical Materials during Manufacture using Nucleonic Gauging Techniques."
6. "Use of Microwaves for the Examination of Rotating Bodies."
7. "Over-voltage Tests on Insulation."
8. "Diagnosis of Failure in Power Apparatus under Impulse-voltage Acceptance Tests."
9. "Assessment of Insulation Serviceability of Turbo-generator Stators and of High-voltage Bushings."
10. "Qualitative Assessment of S.R.B.P. Laminates."
11. "Measurement of Surface Resistivity."
12. "Review of Eccentricity, Capacitance and Diameter Gauges for Continuous Recording of Cable Quality during Manufacture."
13. "Leak Testing during the Manufacture of Sealed-off Vacuum Devices."
14. "Detection of Electrolytic Corrosion on S.C.A. Conductors."
15. "Machine for Automatic Surface Sampling and Automatic Contact Resistance Evaluation (MASSACRE)."
16. "Assessment of Performance of Anti-vibration Materials."

# Developments in insulation

## NO SWEEPING CHANGES IN THE PAST EIGHT YEARS

HELD concurrently with the Engineering Materials and Design Exhibition last week was a five-day conference at which 20 papers were presented on subjects ranging from the aesthetics of machine design to uses of adhesives in engineering. A paper by Mr J. Wainwright of English Electric surveyed recent developments in electrical insulating materials.

Surprisingly, little change had taken place in the insulation of rotating machines during the last eight years, he said, although there was a trend for the continuing substitution of synthetic materials for those based on natural products. Improvements in testing instruments had enabled knowledge of the mechanism of insulation deterioration and failure to be more accurately determined.

Much work remained to be done in the classification of insulating materials with regard, for example, to resistance to discharges and mechanical behaviour at high temperatures. However, some agreement has now been reached on classification in terms of thermal stability.

### Progress with Gases and Liquids

Apart from the use of compressed air in air-blast circuit-breakers, hydrogen was the only gas so far applied extensively for electrical insulation in this country. In America sulphur hexafluoride had been used for two main purposes: as an extinguishing medium for circuit-breakers and as a dielectric in instrument and power transformers. At atmospheric pressure, its dielectric strength was several times that of air, while at twice atmospheric pressure its strength was similar to that of transformer oil. Gases containing fluorine, for example, octafluorpropane, were being applied to Class H transformers. However, it seemed that, in the UK, any developments were most likely to make use of sulphur hexafluoride.

Liquid dielectrics had changed little, but more attention was now being given to the physical and chemical properties of mineral oils. The possibility of using chlorinated aromatic liquids for distribution transformers had been considered, but no general adoption seemed likely in this country. The advantage of absence of fire risk was counteracted by incompatibility with other insulants. High cost also ruled out, except for special applications, the use of silicone fluids or fluoro-chemical liquids.

A great step forward in the use of synthetic resins was accomplished when resins were developed which could be cured without giving off undesirable substances. Resins of this type, the epoxy and polyester resins, accounted for nearly 10% of the thermosetting plastics sold last year in the UK.

Of particular value was the development of resins with high heat distortion temperatures and improved thermal stability at high temperatures. An epoxy resin with a heat distortion temperature as high as 250°C, and another epoxy resin which, used in conjunction with a glass laminate, took 8,000 hours for a 50% reduction in mechanical strength to occur at 180°C, were now available.

By adding mineral powders, such as quartz flour, to an epoxy resin, the price could be reduced to a half or less. On the other hand, glass-fibre increased the cost, but it also considerably improved the mechanical strength of an epoxy resin. Mineral-filled epoxy resin castings were being used for support insulators and for the encapsulation of switchgear and motor windings. Shrinkage was extremely small, but it was still sufficient to cause stresses which resulted in cracks developing later. Resins with greater flexibility were needed.

Uni-directional glass-fibre bands, treated with semi-cured polyester resins, for retaining winding conductors on rotating machines had several advantages over the conventional wire bands. For example, no additional insulation was needed between the band and conductor, the band could be applied close to high-voltage conductors, there were no eddy-current losses in the band and negligible damage would be caused to the machine by a partial band failure. Similar bands were also being used to clamp transformer cores. They were applied under tension and the resin subsequently cured.

Epoxy resin treated glass fabric, although having an initial electric strength somewhat lower than mica-based material was stronger, tougher and had better dimensional stability. Applications included turbo-alternator slot insulation and commutator V-rings. In Japan glass-reinforced resin has been used for the insulation of high-voltage water turbine stator windings, and the author commented that their behaviour in service would be of great interest.

The author commended the use of untreated paper, applied with any necessary stress controlling electrodes and subsequently impregnated with epoxy resin to form high-voltage bushings. One advantage was the removal

*Fig. 1. Coils for a heavy current reactor encapsulated with resin and with inter-coil spacers of similar resin*

of limitation on shape or contour which could be formed and which applied to phenolic laminates in which only straight lengths could be treated.

## Silicone Materials and Integrated Mica

Silicones, he said, were being increasingly used as resins and varnishes, but except for special applications where their high cost was justifiable they were not necessary on large rotating machines which seldom operated at more than Class B temperatures. However, they had excellent resistance to high temperature and to the effects of electrical discharge. They were also able to withstand considerable flexing but, on the other hand, they could be damaged fairly easily by sharp edges. However, in America they had been used for machines of several thousand h.p. and voltages up to 13·8 kV. A development was to use silicone elastomer reinforced tapes as moisture seals on top of conventional insulating materials.

Some manufacturers were using integrated mica instead of sheets formed from mica splittings. Integrated mica was made by breaking down mica plates into pieces only a fraction of a sq mm in area and forming them into sheets on a paper-making machine. The mica was then reinforced by glass, probably treated with epoxy resins. The advantages were much closer tolerances on thickness, the possibility of using poor quality mica and absence of swelling at high temperatures. It was unlikely that electrical discharges in cavities in the material would reduce it to powder form although this at one time seemed a possible disadvantage.

Integrated mica could also be used in high temperature, air-cooled transformers as conductor insulation, and it had already been applied to traction motor field-coil insulation. The traction motor coils could also be bonded to the poles by filling the gaps between them with epoxy resin.

Improvements in thermal stability of conventional materials, such as paper and pressboard, of the order of 20°C were reported from America, but the treatment materials were not yet available in this country.

## 345 kV Plastics Cable

Mr Wainwright referred to the US development of a 345 kV cable using polycarbonate film as major insulation with mineral oil impregnation. In recent years the use of plastics film for high-voltage apparatus had been under investigation and cables had been tested with films of polyethylene terephthalate, polypropylene and polycarbonate.

For complete impregnation two methods had been developed; either the film was used alternately with layers of cellulose paper or the film surface was etched to form grooves along which the impregnant could penetrate. Mr Wainwright thought it probable that these films would tend to replace paper. However, there was a danger that, under short-circuit conditions, cables and transformers would attain temperatures at which the film might melt.

A fantastic rate of increase in the use of pressure sensitive plastics films had occurred, he said, over the past few years. Polyethylene terephthalate was now, for some applications, replacing p.v.c. and polyethylene. It had been suggested as suitable for Class F temperatures, it had remarkable high tensile and tear strengths, and it was available in thicknesses as low as 0·002 in.

Useful materials were also obtained by bonding films to presspaper or vulcanised fibre and these were being used for industrial motor slot insulation.

Turning to a consideration of impregnating varnishes, Mr Wainwright said that silicones were still used for most Class H applications and new types appeared from time to time. It was doubtful if epoxy resins would be used for large-scale impregnation for some time because of the practical difficulties. Good performance, at least up to Class F temperatures, was obtained with varnishes now available based on iso or terephthalaic acids.

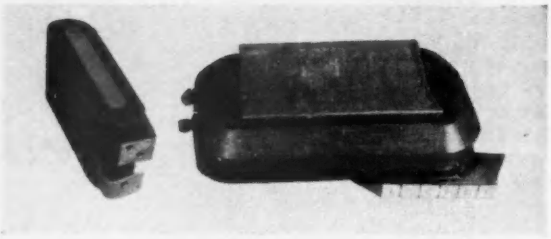


*Fig. 2. Protection against dirt, brake dust, snow and water is given to traction motor coils by using integrated mica and epoxy resin insulation. The coils can also be bonded to the poles by epoxy resin to prevent damage by vibration*

Varnished fabrics with remarkable resistance to temperatures in the region 130°C to 180°C were available, although one varnished nylon fabric had proved unsatisfactory because it split easily and also melted near brazed joints. A promising material was a rubbery varnish applicable to glass fabric consisting of polyurethane resin.

Referring to enamels, Mr Wainwright said there had recently been conflicting statements about the effect of encapsulating resins on enamelled wires and there was little enthusiasm for epoxy enamels. In the US the trend was to standardise on polyester enamels for all applications up to Class F. A new but promising material was claimed to be suitable for temperatures up to 220°C. Little was known of its properties except that it was an organicimide.

## Switchboard Wiring

For switchboard wiring, the disadvantages of p.v.c., for example, a tendency to flow under pressure and to brittleness with ageing, were not found with butyl rubber. This material remained undamaged at temperatures when p.v.c. would have melted but, on the other hand, it supported combustion. Later, use would probably be made of polypropylene and increasing use was already being made of polyethylene and p.v.c. for power cables. Cables for up to 35 kV now used these materials.

Although nuclear radiation generally caused severe deterioration of insulating materials, radiation in some cases improved characteristics and irradiated polyethylene tape had been used in Class A rotating machines as a coil insulation because it was impervious to moisture and carbon black.

The difficulties of applying insulation to some components, particularly those with sharp edges, could be overcome by using the fluidised-bed technique, in which particles of the insulant were supported in a gas, so that they behaved rather like a liquid. Insulation thicknesses from 0·005 in. to 0·05 in. could be applied uniformly, even to sharp corners, and this technique had been used in the US to insulate low-voltage stators and armatures, and 11 kV busbars. The technique had also been used to apply a thick insulating coating to transformer covers to prevent birds causing earth faults.

Among the other papers presented at the conference was a survey of recent developments in permanent magnet materials by J. E. Gould and a paper on recent developments in graphite by Professor A. J. Kennedy. Messrs Franks and Smith discussed the use of elastomers in engineering, with particular reference to natural rubber compounds and two papers by Vinson and Smith described plastics-coated steel applications and fabrication techniques.

# Suppressing Transformer Noise Simply

WHEN objections to noise from transformers sited in residential areas become sufficiently pressing it would seem logical, since the transformer has a rectangular plan, to put it in a rectangular brick enclosure. This method has, of course, been used and so have rather more complicated methods using steel enclosures and sound-insulating or sound-absorbing materials, but it is refreshing to discover that a simple and inexpensive circular brick enclosure seems to hold quite a lot of promise.

Last week, Transformers (Watford) Ltd. demonstrated how noise from a 300 kVA distribution transformer could be reduced by a circular brick enclosure and, although the background noise from local factories was rather high, the effect of the enclosure was quite marked.

The transformer used had its flux density raised to 19,500 gauss to increase noise emission. Tests conducted at night in accordance with Electricity Board requirements have shown that the maximum noise level measured at any distance from the enclosure and at up to 20 ft above ground level was 44 db, compared with 64·5 db with the transformer unenclosed. Tests were made with a Dawe objective sound meter, using a weighting of 40 db since, even at night, this corresponded to background noise level.

An enclosure 8 ft dia. and a few ft higher than the transformer would be adequate for a 500 kVA transformer, switch and feeder pillar unit with room to pass round the unit to those parts needing maintenance. For small units, access could best be obtained by portable ladder, over the side of the enclosure. For larger enclosures doors could be built into the brickwork.

Enclosures can be built for several diameters with bricks similar to those used for chimney construction. This type of construction has several incidental advantages. Bricks are available in several colours and patterns, enabling the enclosure to blend with local features and a single thickness of brick is said to give an enclosure with sufficient inherent strength for diameters of 20 ft or more. The bricks are curved for the diameter chosen and, unless doors are necessary, there would be no need to cut half bricks. The simple construction possible is claimed to give an enclosure for about half the cost of a rectangular enclosure for the same size of transformer.

A notable advantage claimed for the circular construction is that sound from the top of the enclosure is funnelled upwards and away from nearby windows of houses or flats above ground level. Measurements made at heights up to 6 ft above the rim of the enclosure showed an 8 db to 10 db reduction in level compared with that at rim level, but inside the enclosure.

Oil coolers would be mounted outside the circular brick enclosure, and the company are now considering how best to provide access to the enclosures for large units. They say a 19 ft dia enclosure would house a 15 MVA unit.

# Good Lighting Aids Productivity

FEW factory lighting installations, which conform to minimum standards of the Factories Acts, would meet with the recommendations regarding glare now put forward by the IES, said Dr R. G. Hopkinson, head of lighting research at the DSIR Building Research Station. He was addressing a British Productivity Council conference on ergonomics in the factory and considered that more attention should be given to controlling diffusion from artificial lighting fittings. Attention was particularly needed to prevent a direct view of very bright light sources. Improvements could be made in factory lighting both by diffusing the light source more efficiently and also installing proper cut-off screening devices to limit angles from which light could be seen.

Glare, he said, was a function of contrast as well as absolute brightness. This being so, discomfort caused by glare from lighting fittings in a gloomy surrounding was much greater than from the same fittings in brighter environs.

Although glare could be present without any reduction in the ability to see, the long term effect of such glare on productivity needed to be borne in mind as it had an effect similar to excessive noise or other like discomfort.

Lighting costs over the past 50 years had been reduced by a factor of more than 50:1, and it had been estimated that the cost of lighting in an industrial building was rather less than 2% of the wages bill. Attempts had been made in North America to establish direct relations between lighting and productivity. Some careful costing studies were undertaken, and it had been shown to the satisfaction of management that costs of improved lighting were paid off in periods of less than a year.

Work has been carried out at the Building Research Station, into the question of lighting levels in relation to relative ease of performance. From results, it was possible to assess within reason the amount of light necessary for different visual tasks. Experiments showed that the ratio of illumination required for the same task carried out easily or with great difficulty was about 30:1.

Levels of lighting between 15 and 50 lumens/sq ft. would cover the range of most industrial tasks, and the IES had proposed that there should be a minimum of 15 lumens sq ft. in all work places as a general amenity. At present the Factories Act required a minimum of 6 lumens/sq ft.

Some years ago, said Dr Hopkinson there was no question that daylight should not be the main working illuminant in a factory. Today, however that position was considerably changed. Although daylight was abundant, it could be quite costly to direct it to parts of a factory where it was needed without increasing costs through causes such as the loss of internal heat through windows.

Recently studies had been carried out at the Building Research Station on a system of mixing artificial and natural light. It was a system where daylight was still dominant, but working illumination was partially provided by artificial light. Levels of supplementary lighting were calculated from the adaptation of conditions in a building. Necessary levels of supplementary lighting were of the order of between 40 and 100 lumens/sq ft. This meant that artificial lighting for night time could be lower than that which was provided for supplementing daylight. For that reason, the introduction of a switching arrangement to reduce artificial lighting in supplementary areas when daylight faded might be necessary.

If new ideas such as these were to be implemented, there had to be co-ordination of work between lighting engineer and architect when a factory was being built. This should preferably be at the design stage.

# new products and appliances

### HMV's First new 'Fridge

FIRST of the new HMV refrigerators to be introduced is a 6·8 cu ft model which is designed to meet a demand for larger 'fridges. It is fitted with a thermostatically controlled compressor unit. A large, full width freezer compartment provides storage space for approximately 28 lb frozen foods and two large-size ice trays. The model has three interior shelves, two of adjustable chrome plated wire, and the other of glass covering a deep vegetable storage drawer. The door liner gives ample storage space for dairy foods and has two large bottle shelves. The door can be either right- or left-hand opening as required and the refrigerator is fitted with adjustable feet. Finish is in white or cream enamel with pale pink interior. This model is priced at 69 gn including purchase tax and surcharge. *HMV Domestic Appliances Ltd., 363 Oxford St, W.1.*

### Time switches for appliances

A RANGE of clockwork and synchronous motor operated time switches has been announced by Crater Products. They are designed chiefly for use with domestic appliances such as washing and drying machines and dish washers. Manufacturers claim that due to greater versatility the clockwork timers can be used for quite complicated circuits which previously required a synchronous motor driven model. The synchronous motor types are available with either "push, or twist-to-start" control. In certain cases a manual hold position can be incorporated. *Crater Products Ltd., Lower Guildford Rd, Knaphill, Woking.*

*First 'fridge from HMV Domestic Appliances is this 6·8 cu ft compressor model*

### Precision soldering

SOLDERING tweezers are an interesting addition to the range of miniature soldering instruments manufactured by Oryx Electrical Laboratories. Designed for close precision work on micro-miniature circuit modules, semiconductors and relays, the tweezers have 1/32 in. tips with separate elements giving simultaneous heating on both sides. The elements operate up to a tip temperature of 554°F from a 6 V supply resulting in reduced heating times and the elimination of cold joints. Light to handle and requiring minimum finger pressure, these tweezers provide an unobstructed view of the work in hand. *Greenwood Electronic Ltd., 677 Finchley Rd, N.W.2.*

### Plastics cap for lightning arrester

TO overcome the problem of damage in transit to end caps of EMP lightning arresters, a new cap has been developed using a polyester-glass fibre moulding material. Known as Rockite DMC, the material has high mechanical strength allied with good electrical properties. The cap is claimed to be electrically equivalent to the former porcelain type and will withstand thermal stress experienced in extreme temperatures. *British Resin Products Ltd., Devonshire Hse, Piccadilly, W.1.*

### Low cost lifting magnet

A BATTERY-operated magnet, which is said to reduce costs of lifting and handling metals has been introduced by Rapid Magnetic. Designated "Magna Grip" it has the advantage of being independent of mains supply and can be attached to mobile cranes or static hoist blocks. Remote control switches can be provided when it is used in this manner. A recessed control panel houses the switch and trickle charger socket as well as a recharging indicating meter. Battery capacity is sufficient for a full days work and recharging is done overnight. There is a range of three models. The smallest model operating from a 6 V supply has a 1-ton lifting capacity and the other using 12 V and 24 V supply can lift two tons and three tons, respectively. These figures relate to solid steel blocks with machined surfaces. *Rapid Magnetic Ltd., Lombard St, Birmingham 12.*

### Finnish lamps for UK

A RANGE of Finnish incandescent lamps which are designed for use without shades are now available in the UK. They are manufactured in Helsinki and are at present on show at the Finlandia exhibition. The lamp, which is diamond shaped, will blend with modern decor and is supplied in 40 W and 60 W ratings. It is made with both bayonet and screw fittings and said to have an average life of 1,500 hr. The filament is normal single spiral and envelopes are gas filled. Retail price is 12s 6d, including tax. Distributor: *A. A. Kalev, 38 Endlebury Rd, E.4.*

### Moving coil relay

RELIABLE contacting performance at low operating currents has been achieved by the Austinlite Centre Zero moving coil relay using a new high torque magnet system. Two fixed contacts, one on either side of the moving contact, can be adjusted to close at any pre-set point between 0·5 mA and 1·5 mA. Contact rating for d.c. non-inductive circuits are 50 V, 200 mA to 250 V, 25 mA, and for d.c. inductive circuits 50 V, 50 mA to 250 V, 10 mA. The instrument can be mounted in a horizontal or vertical position, but situations likely to receive heavy vibration should be avoided unless the relay is fitted with anti-vibration mountings. As a detecting unit in a bridge circuit this relay has applications such as earth-leakage detection on large battery installations and automatic machine control. It can also be used for low current detection in electronic circuits. Another feature is the suppressed zero giving a slight bias on the control spring where the relay must fail to safety. Physical dimensions and appearance are similar to those of the previous Mk IV unit. *Austinlite Ltd., Schomberg Hse, 82 Pall Mall, S.W.1.*

*Austinlite moving coil relay for low operating currents, incorporating a new magnet system*

### Elapse time indicators

A RANGE of Bach Simpson elapsed time indicators is now available in this country. These instruments, which are said to give an accurate check of operating life of equipment, are supplied in ranges suited to most a.c. applications. They employ self-starting synchronous motors in conjunction with five digit or six digit counters. The assembly, which has been redesigned, features loose "paddle-wheel" linkage and a counter composed of large separated numeral wheels set in a specially tooled frame. These are claimed to give greater legibility and improved performance. *Agents: Aveley Electric Ltd., Ayron Rd, Aveley Industrial Estate, South Ockendon.*

### Prices . . .

R and A Main Ltd. have altered the price of their Mainspin Dryer and it sells now at 22 gn. This became effective on 6 Nov.

Easco have reduced prices on several of their "Eascolyte" battery-operated fluorescent lighting units. New prices took effect on 20 Nov.

Prices of their domestic and industrial thermal storage heaters have been increased by Thermodare (Gt. Britain). The increase is attributed to rising wages and transport costs. Prices now range from £17 12s 3d to £25 18s.

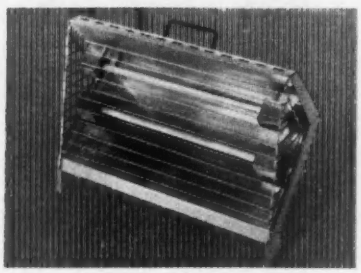
### . . . and Packs

Morphy-Richards have introduced a new display pack for their standard and presentation shavers. It is a stand designed for the younger generation. The back panel is topped with a facsimile record cover entitled "Play It Smooth, Man."

A new presentation box has been designed for the Pifco "Princess" hairdrying ensemble. All items are now sold in one pack instead of two as previously.

### Infra-red heater

A NEW 2 kW infra-red heater has been announced by Stokvis. Called "Como" it is a floor model unit and has two 1 kW elements in quartz tubes. The elements are separately switched and a channel round the back of the reflector is fitted with top and bottom louvres to obtain added convected heat. The unit is available in Mediterranean blue or citron and is 19 in. wide by 14½ in. high and 9 in. deep. It weighs 9½ lb and retails at £10 10s 8d. *R. S. Stokvis and Sons Ltd., High St, Walton-on-Thames.*



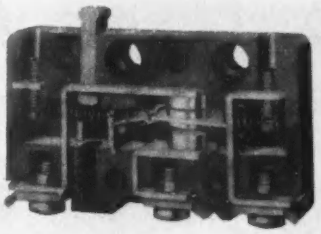
*"Como," the new Stokvis infra-red heater with two 1 kW quartz encased elements*

### New low-cost recorder

AN inexpensive recording instrument for the simultaneous plotting, on a cartesian graph, of two independent d.c. sources has recently been announced. The movement is a servo-type responding to the two separate voltages and is linked to the pen which traces the resultant graph on 8½ in. by 11 in. paper. Two models are available; one has a sensitivity of 1 mV/in. and the other, 10 mV/in. The low price of the instrument makes it particularly suitable for universities and technical schools but it also is invaluable in works laboratories where a number of recorders are required on a single investigation. The recorder is supplied complete with all accessories and components.—*Central Scientific Co., Chicago, Illinois, USA.*

### Double action micro-switch

BY using two separate springs, one for contact movement and the other for contact pressure, the new Chilton microswitch is claimed to overcome bounce and resulting burning of the contacts. An operating plunger starts the snap action of a fork which actuates a moving contact carrier and this in turn snaps over to the opposite fixed contact. The actuating fork thus prevents any unstable condition being transmitted to the contacts. The actual contact pressure between the moving and fixed contacts is then applied by the second spring acting on the contact carrier thereby maintaining constant pressure independent of the position of the operating plunger. The MS10 switch is said to be particularly suited for arduous duty as a limit, control or safety switch. *Chilton Electric Products, Hungerford, Berks.*



*Chilton's double action micro-switch MS10*

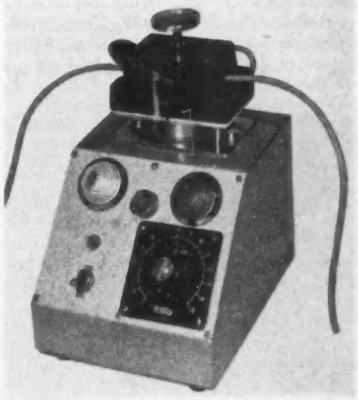
## P.V.C. joints by unskilled hands

THE Egerton New Way cable jointing machine is a portable self-contained apparatus providing a quick and simple method of producing permanently insulated, water-tight and flexible joints on cables sheathed with p.v.c. It can also be readily adapted for the repair and jointing of polythene sheathed cables. The machine is claimed to be virtually foolproof and can be operated by unskilled labour. The method of jointing ensures that there is complete amalgamation of the jointing material with the original sheathing of the cable, resulting in joints having electrical and mechanical properties similar to those of the original cable.

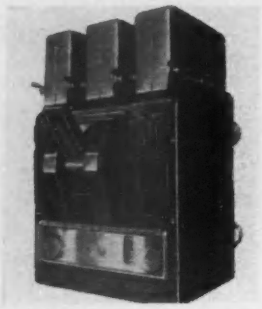
When jointing p.v.c. sheathed cables, the joint is placed between the two halves of a moulding jacket held together with split-rings. A special plastics composition, Vinagel VG133, is then forced into the moulding jacket by means of a mould filling gun. With the loaded moulding jacket placed between thermostatically controlled platens, it is heated to 170°C, the curing temperature of the Vinagel. Since the joint does not reach its maximum strength until cold it must be allowed to cool before opening the moulding jacket. A timing device denotes when the jacket may be removed from the platens.

The attachment for jointing polythene-sheathed cables consists of a barrel with a screwed plunger which is placed between the heated platens of the p.v.c. machine. The thermostat setting is increased to about 200°C. Before placing the barrel in position, the plunger is removed and a solid polythene charge loaded into the barrel. When molten the polythene is transferred under pressure to a heated mould by means of the hand operated screw plunger. To prevent flow of heat along the cable, water cooling is introduced at the extremities of the mould.

The New Way machine is so designed that it can be adapted to make numerous types of joints, including Y and T joints. Two standard sizes of machine are available. The P1 has a capacity of $\frac{7}{16}$ in. dia for a straight-through joint made with butt-brazed or butt-welded conductors and up to $\frac{1}{4}$ in. dia for a bulbous joint for moulding over crimped or ferruled conductors. The capacity of the P2 is up to $\frac{11}{16}$ in. dia for a straight-through joint and $\frac{7}{8}$ in. dia for a bulbous joint. *Vinatex Ltd., Devonshire Rd, Carshalton, Surrey.*



*Portable cable jointing machine providing a quick method of jointing p.v.c.-or polythene-sheathed cable*



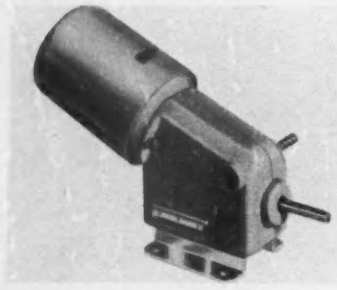
*Type Z630 600 A air circuit-breaker from Italy*

### Italian moulded c.b's

A COMPLETE range of moulded case automatic air circuit-breakers by Sace of Bergamo, Italy, are now available in this country. They are being manufactured under licence by GWB Furnaces. Small and compact these c.b's have a high making and breaking capacity and range from 60 A to 4,000 A. They can be supplied in two- three- or four-pole designs and are said to be approved for industrial and marine use. GWB are manufacturing two ranges, the Isol series, Type 3 x up to 600 A and the Otomax range with ratings between 800 and 4,000 A. Varying methods of mounting are available to suit individual requirements and there is a comprehensive range of ancillary fittings. *GWB Furnaces Ltd, Dibdale Wks, Dudley, Worcs.*

### Geared to suit

TO meet the need for a compact variable drive in the range of very low powers, a fully enclosed motor and gearbox has been developed giving a comprehensive range of speeds. Designed for continuous running, the RZG unit incorporates a single-phase induction motor with an input of 50 W which can be wound for any a.c. voltage supply between 6 V and 260 V. A mechanical stepless drive with two output shafts provides a speed variation on one shaft of 110 r.p.m. to 1,700 r.p.m. On the other shaft, at right angles to the motor, one of five possible ranges are available between 3 r.p.m. and 235 r.p.m. Where lower speed shafts are required an extra gear reduction can be provided offering one of 20 different speed ranges down to as low as 0·0013 r.p.m. to 0·02 r.p.m. The output torque of the unit varies from 21 lb in. at 10 r.p.m. to 1¼ lb in. at 300 r.p.m. The RZG can be supplied with or without the low speed shaft and additional reduction gearing. If reversing is required a capacitor motor can be fitted. Weighing only 5¼ lb, the two shaft unit has an overall length of 205 mm. *Jones and Stevens Ltd., Eastern By-Pass, Oxford.*



*Designed for very low power purposes, a compact variable transmission using a mechanical stepless drive*

### Welding flux separator

SUITABLE for mild steel submerged arc flux and some hard surfacing fluxes is a magnetic separator by Armco. In design it is similar to a strainer; the top portion of the equipment is a cylindrical hopper 10 in. dia and 3 in. deep. Slots in the base permit granular flux to flow through the hopper. Beneath the slots are solid cylindrical magnets over which the flux flows. The magnets trap any steel particles so that only non-magnetic flux flows past. When the magnets have attracted their full capacity, flow through the separator ceases. *Armco Ltd., 76 Grosvenor St, W.1.*

## TRADE PUBLICATIONS

PHILIPS.—1962-63 lighting catalogue and price list for lamps and lighting equipment. Philips Electrical Ltd., Century Hse, Shaftesbury Ave, W.C.2.

STERNOL.—16-page booklet entitled, "The Modern Method of Quenching Steel." Sternol Ltd., Royal London Hse, Finsbury Sq, E.C.2.

TURNER BROS.—New flat transmission belting catalogue. Turner Bros Asbestos Ltd., Rochdale.

METWAY.—Eight page leaflet describing plug-in cable connectors. Metway Electrical Industries Ltd., Canning St, Brighton.

K. S. PAUL.—Second edition of illustrated booklet entitled: "Molybdenum Disulphide In Action." K. S. Paul (Molybdenum Disulphide) Ltd., Angel Rd, N.18.

CAV.—Leaflet describing new electric starter for diesel engines. CAV Ltd., Acton, W.3.

CAMBRIDGE.—Brochure detailing range of humidity instruments. Cambridge Instrument Co. Ltd. Mechanical Thermometer Divn, Friern Pk, N.12.

BIRFIELD.—Brochure, "Facts on Cold Extrusion," by Forgings and Presswork Ltd., Birfield Ltd. Group, Hill St, W.1.

## Instantaneous recording of fault operations

DESIGNED for installation in control rooms governing a number of unattended switching points, the Le Boeuf fault recorder gives a clear analysis of any sequence of faults from the action of up to 60 remote signal switches. When a fault occurs, the instrument summons attention by audible and visual warning. The type of fault is indicated and, if more than one, in which sequence, and leaves a printed record for subsequent investigation.

Under normal conditions the chart is stationary, but on operation of one of the signal switches, the chart accelerates to the high speed of 2 cm/sec. The time of incidence is recorded and also the identity of the signalling switch. Thereafter, a timebase is formed by the printing of a line for every alternate half-second. This makes possible the reading of the exact time of any further signal that occurs while the chart is running. The chart stops automatically 2 sec after commencement of the last signal.

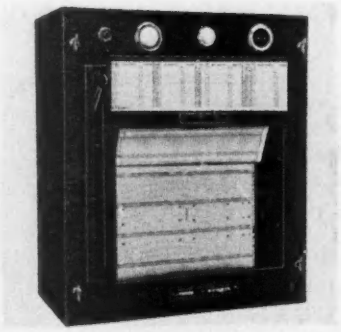
Time of starting is recorded by a horizontal row of five dots, printed in groups of columns giving the exact second of initiation. Each signal for fault recordings appear in one of the columns also used for time or other markings and has the same reference. A fleeting signal is printed in the form of a tapered line of about 1 cm long, sustained faults printing a continuous line.

Other recordings include provision for a mark to appear in a separate column if ever the chart is started manually and, whenever a time marking is made, a dot identifies the recorder.

The method of recording employs a spring-loaded tungsten-tipped stylus for each channel and this rests permanently against a thin metallic film on the chart. When a signal is passed from any stylus via this film to a common graphite contact, the film will evaporate under the stylus leaving a dark translucent mark which can be reproduced on a photo-copying machine. If the chart is stationary, this will become a round mark and the current will stop flowing due to loss of conduction of the metallic surface, but if the chart is moving, a continuous line will be recorded.

The 60 signal switches connect to terminals on an input unit which is usually mounted remote from the recorder. Sixty individual channel filters shape the signals to make them suitable for recording. The timebase comprises a master unit, a slave pendulum and time-lagging elements.

The recorder has been designed for a power supply of 48 V d.c., but may also be supplied for higher voltages. Under no-signal conditions the drain is only 8 W, increasing to 130 W for maximum conditions. Recorder dimensions are 18 in. by 16½ in. with a 7½ in. projection in front of the mounting panel. Other applications include checking the automatic starting up of steam generating plant under computer control and for monitoring petrol refining plants, gas producing plants and various chemical processes. *D. Robinson and Co. Ltd., 5 and 7 Church Rd, Richmond, Surrey.*



*Le Boeuf fault recorder with chart cutter on extreme left*

# News of the Week

## SUPPLY SETTLEMENT IRKS GOVERNMENT

### Pay pause holds good, P.M. implies

THAT the wage claim settlement for manual workers in the electricity supply industry, agreed last Thursday, was against the Government's expressed view, was evident from the statement by the Prime Minister in the House of Commons last Tuesday. He said the Electricity Council officers had been left under no doubt as to the importance which the Government attached to the pay-pause policy. He pointed out that previous wage settlements in the electricity supply industry had run either from the date of agreement or had been backdated, whereas the present settlement would not take effect until 28 Jan. next. Nevertheless the Government did not regard this settlement as being consistent with their pay-pause policy, and when the Minister of Power was informed late on Thursday that a final offer was about to be made he expressed great disquiet and emphasised the damage that a settlement on the terms proposed would do, Mr Macmillan said.

With the settlement of the wage claim for manual workers in the electricity supply industry, related claims on behalf of other employees in the industry may follow soon. First of these will be for the clerical and administrative staff, on whose behalf a request for a review of the structure of the salary scales has already been submitted, along with proposals. These are to be discussed at a meeting of the Negotiating Committee of the NJIC on 6 Dec.

It may not be long before the technical staff follow suit, for, although the EPEA earlier indicated that they recognised the Chancellor's pay pause, they did state that if any other sections of employees received an increase in pay, the question would have to be reconsidered.

The new agreement for manual workers in the supply industry gives a 2d an hour rise to all, as from 28 Jan. next, and for those with over two years' service there are additional payments of 5s per week for men on Grade A, and 5s 6d for those on Grade B, with a further 6d for each next grade up to 8s 6d for Grade H. It was also agreed to have a meeting early next year to discuss measures to increase productivity and improve the men's status.

### Free entry for Japanese Appliances

UNRESTRICTED entry for Japanese electrical appliances into the UK continues under interim arrangements announced by the BoT pending the outcome of current trade negotiations. Interim quotas have been set by both countries on an as-you-were basis, but this affects only sewing machines and transistor radios or record players as other appliances are quota free. As we reported on 9 Nov., Wholesale Supplies (Swinton) are now distributing Japanese toasters, and electronic cookers are expected to arrive soon.

### Another m.c.b.

ANOTHER prominent British concern is to enter the moulded circuit-breaker market—GWB Furnaces Ltd. Their Control Gear Division have been appointed sole licensees in Gt. Britain for the range of moulded case automatic air circuit-breakers designed by the Sace Co., Bergamo, Italy. Other details are given on page 782.

### E.T.C.T.A. form National Council

SINCE its inception 36 years ago, general administration of the Electrical Trades' Commercial Travellers' Association has been the responsibility of the London branch officers. But with the continuing growth in membership, with four branches and the prospect of a fifth (at Liverpool), it has been decided to form a National Council. That decision was approved last Friday, when Mr J. G. Christopher (of Thorn) was elected president, with Mr A. M. Scales (founder chairman of the Scottish branch) as chairman, and Mr L. A. Fickling as hon. secretary. From the Association's funds, cheques totalling over £760 were presented to the Royal Commercial Travellers' Schools, and of £500 to the EIBA (on whose behalf Sir Leslie Gamage received them). To the latter sum, Mr D. G. Barrie, of Metway Electrical Industries, added a seven-year covenant for £350 as a memento of the company's jubilee.

## S.T.C. TO OPEN BELFAST FACTORY

CHEERS in the Ulster Parliament greeted the announcement during the week that Standard Telephones and Cables are to establish a telephone factory near Belfast which will employ 2,000 people. So badly had the area been suffering from unemployment that the local urban council had taken the unique step a few months ago of calling for a day of prayer in the churches on this problem, and now, says the council's chairman, "we have had our prayers answered."

**STC plan to occupy immediately a new 50,000 sq ft Government factory on Monkstown industrial estate, eight miles from Belfast on the north-west shore of Belfast Lough. This will provide facilities to train operatives and start production. Meanwhile, a further 150,000 sq ft factory will be erected alongside.**

When the two stages are in full production the project will employ some 1,200 men and 800 women, recruited locally for posts at all levels. The NI Minister of Commerce expects this stage to be reached within five years.

The main products to be made on the 20-acre to 30-acre site will be telephones and telephone exchange equipment. The new factory will form part of STC's Telephone Switching Division.

## *Nuclear Explosion as Possible Power Source*

NEXT month the US will carry out an underground nuclear test explosion and an attempt will be made to utilise the energy liberated to generate electric power. The explosion will be in a salt formation in New Mexico, 1,200 ft below ground level. Project Gnome, as it is called, will liberate intense heat, but it is thought unlikely that more than a fraction can be recovered. The explosion is expected to form a molten salt lake containing about 6,000 tons of salt at a temperature which, while initially reaching many millions of degrees, will rapidly fall to about 1,400°F. Water will be dropped through pipes to the explosion site and, after pumping it to the surface, an attempt will be made to use it to generate electricity. The director of the AEC division of Peaceful Uses of Nuclear Explosives said it might be possible to trap some of the heat of the explosion so that it could subsequently be used for power generation.

Ninety-nine lighting units, each with two 150 W lamps, are built into the wall of the 46 ft diameter pond to light this Goodwin Fountain in front of Sheffield's Town Hall. Alternately red, blue, and green, they are operated by a W. J. Furse motorised choke dimmer. Lighting the central jets are 12 500 W underwater reflector lamps in three groups, also with colour changing. It was designed and constructed by Mr C. R. Warman, city engineer and planning officer, with lighting arrangements by Mr J. Woodhouse, public lighting engineer

# SHAKE-UP FOR RESEARCH ASSOCIATIONS ORDERED BY MINISTER FOR SCIENCE

THE time has come for a shake-up in the research association field, the Minister for Science told the House of Lords last week. He has called for action by DSIR. Details were not given by the Minister, Viscount Hailsham, who was replying to a debate on scientific manpower and research.

Lord Hailsham recalled that the Government policy that the research associations should become self-supporting had been abandoned. However, he was not in agreement with the idea of straight increases in Government grants. In the last ten years the proportion of Government grants to the contributions from industry, as members of associations, had fallen from 1:1·65 to 1:2·60. The absolute value of Government grants had risen by about 60% in the same time.

**Lord Hailsham announced that DSIR had been given authority to proceed with two major projects by way of civil development contracts. Such contracts, analogous to those long familiar in the defence field, are reckoned suitable to complement the work of the National Research Development Corporation. Again, details were left for the future.**

During the debate, several speakers emphasised that the recent estimates of forward requirements for scientists and technologists should not be allowed to give the impression that recruitment needed to be slowed down.

## E.D.A. Industrial Development Conference

SOME 125 delegates from the electricity supply industry in the UK and Eire, plus eight from overseas, attended the fifth EDA Industrial Development Conference, at Bournemouth, earlier this month. The conference was opened by Mr A. N. Irens (SWEB chairman), who is chairman of the EDA Industrial Development Committee, and on the first morning two papers were given—"New Developments in Industrial Lighting," by W. Robinson, and "Steam and How to Raise it Electrically," by J. C. Edwards (Bastian and Allen). That afternoon and the following day was devoted to visits to various works. On the third morning papers were given on "The Approach to Industrial Load Factor Improvement," by W. B. Parkinson (MANWEB), and on "Electrical Utilisation from the Consumer's Angle," by Lt-Col W. E. Dennis (George Wimpey), followed by further works visits that afternoon. On the final day, papers were given on "Metal Melting from the Smaller User's Point of View," by Dr A. G. Robiette, and "The Principles of Industrial Control Systems and the Terminology Used," by R. S. Medlock (George Kent), followed by an open forum in the afternoon, and a dinner to conclude the conference.

## New Westool Factory

A NEW 7,500 sq ft factory for the exclusive production of transformers has been acquired by Westool Ltd. The factory is 150 yd west of the company's main plant at St. Helens Auckland, Co. Durham. Arrangements have also been made to secure adjacent land for further development. The new factory is a self-contained specialist unit designed for production with flow-line winding, assembly and inspection, together with integration of planning and engineering functions.

## REVISED NORTHFLEET 275 kV LINE

FOLLOWING strong local objections, the CEGB has submitted new proposals for the Croydon section of the 275 kV line from Beddington to Northfleet. They now propose to place underground the route through Monks Hill estate and across Selsdon Pk Rd to the existing 132 kV overhead line. At this point there would be a terminal tower with the line continuing overhead. As the LCC are opposing the installation of the line in the Green Belt, and Kent County Council have under consideration the Board's proposals for continuing the line to Northfleet, it is planned to have a joint meeting of the local authorities.

## DOUBLE CHECK ON METERS

DURING 1960 and the first six months of 1961, 299 applications for consumers electricity meters to be checked by independent meter examiners were received by the Minister of Power. Stating this in the Commons on Monday, the Parliamentary Secretary to the Ministry said that electricity boards had standing instructions to tell consumers about the right of independent meter determination, whenever the accuracy of meters was disputed. However, boards were often able to settle cases of dispute satisfactorily without resorting to independent determination.

## 625 kW FURNACE FROM CANADA

A NEW 625 kW roller-hearth electric furnace for heat treatment of silicon steel laminations as used in motors and transformers was shipped from Canada last week to Britain. To be installed at the Bilston works of Joseph Sankey and Sons, it has been made by the Canadian General Electric Co. It seems that the company offered a shorter delivery time.

The Banking Hall of the new Ottoman Bank, Salisbury, Rhodesia, has GEC lighting comprising 5 by 5 light brackets and 5 by 20 pendants using Variform attachments. Rinaldi, MacDonald and Harvey were the architects

# NATION WAITING FOR "ANGRY YOUNG EXPORTER"

IT seems only yesterday that, as a result of the devastation of world war, practically the only business problem was to produce—and to obtain the materials and equipment with which to produce—selling took care of itself. Significantly, two of the sub-headings of a paper on the *Leads and Lags of Export Marketing*, which Mr N. A. H. Stacey presented at the Institute of Bankers on Tuesday, were "Worship of Production" and "Neglect of Marketing." However, in a pungent examination of Britain's export position, Mr Stacey, who is GEC's economic and marketing adviser, virtually takes as read the comparatively recent change from a sellers' to a buyers' market, which is universal anyway, and concentrates on the longer-term background to the present British attitudes, relating these to the Common Market.

In particular, the notion of "he who produces is blessed," while the reverse applies to he who sells, is criticised. The engineer, important and worthy as he is, must be brought down from his pedestal because his counterparts in a dozen countries can do the same these days. With British industry spending £350 million a year each on technical research and advertising, the important thing now is to allocate considerably more than the present meagre £5 million to the allegedly "airy-fairy" activities of the market researcher.

**What are the tasks of this poor relation? To ascertain customer preference, to define the characteristics of the market, to estimate volume of sale, to obtain information on competitive manufacturers' products and prices, to check on the efficiency of publicity, to secure economic information on likely developments in the future. Far from inessential overheads, Mr Stacey speaks of the "high cost of low overheads."**

So ineffective did the speaker regard a permanent cacophony of exhortations that he would tone down "export or die!" to "enrich yourself by exporting." Indeed, the hidden persuaders such as social status were regarded as more to the point, and it is in this connection that Mr Stacey says the nation is waiting for a cult of "angry young exporters."

## Faraday lecture on communications

WITH communications playing such an important part in our present-day world, the choice of the subject, "Expanding Horizons in Communications," for the IEE's 1961-62 Faraday lecture should ensure an interesting evening for the audiences. The lecture, being given by Mr D. A. Barron, deputy chief engineer of the British Post Office (who has had 34 years' experience in that sphere), was first given at Bristol and Cardiff this week. It reviews the means available for automatically interconnecting subscribers, with demonstrations of the principles of local, national and international automatic switching, and the progress of cable development over the years. From the multi-channel radio systems, Mr Barron traces development up to the present time when attention is focusing on the utilisation of artificial satellites to redirect radio beams to selected points. It should be a fascinating lecture.

## Quick Recovery from Fire at Ascot Lamps

THE Dalston factory of Ascot Lamps and Lighting Ltd. was back to almost full production by the end of last week following a fire on the night of 7 Nov. The fire, which affected the running of machines throughout the plant, had completely gutted the special lamps and components section, but by Friday evening the painters were putting the finishing touches in this section. Instrumental in the quick recovery, said Mr G. A. Cawood, the sales manager, was the attitude of the insurance companies, whose main concern had been to get production going again.

## Story of the Oil Engine

COVERING the period from 1861 to the present day, a new film from Shell contains many old photographs and plans never previously seen outside museums and libraries. Entitled "A History of the Oil Engine," the historical sequences are in black and white, with a short Eastmancolor sequence at the end dealing with modern uses of the oil engine. With a running time of 33 min, the film is available in 35 mm or 16 mm on free loan from Shell-Mex and BP Ltd., Shell-Mex Hse, Strand, W.C.2.

## 1,643 kW Road Heating at Hammersmith

THE carriageways of the new flyover at Hammersmith, opened last week, will be free from ice hazards in frosty weather, thanks to the electric road heating installation by BICC "Panelec" cables, of which some 66 miles have been installed. The total loading is 1,643 kW and it is distributed over some 15,000 sq yd of area, the load being adjusted to 10·4 W/sq ft on the embankments, 12·5 W/sq ft on the inner lanes and 13·2 W/sq ft on the outer lanes. This variation takes care of the different masses of the structure and is effected by varying the spacing between the cables.

The cables, comprising a single-core, seven-strand resistance element butyl insulated in a nitrile-butadiene sheath, are laid across the roadway between temporary jigs to ensure correct spacing, the intervening gaps being filled with hand-laid, light roller-compacted sand asphalt. The whole is then overlaid by a further $\frac{1}{4}$ in. layer of sand asphalt on top of which is the machine-laid asphalt.

The panels are broken down into units of $1\frac{1}{2}$ kW, 2 kW, 3 kW and 4 kW and are supplied with off-peak current by the LEB from three 500 kVA, 6·6 kV/440, three-phase transformers, two of which are in the eastern abutment and one in the control chamber within the western abutment. Automatic control ensures that the current is switched on when the road is wet and the temperature, as monitored by thermocouples embedded in the road surface, falls below 37°F.

The flyover, 2,831 ft long, carries traffic over the complex road intersection at Hammersmith and joins the Cromwell Rd extension to the King St approach to the Great West Rd. It is of cantilever construction supported on single tapering columns and provides dual 24 ft carriageways, a median strip and footways. It is believed to be the first flyover with electric road heating.

The installation was designed by G. Maunsell and Ptnrs, in collaboration with the Road Research Laboratories, and was carried out by Alliance Electrical Co.

*A general view of the flyover with heating cables being installed in the foreground*

## MAGNET AGREEMENT IN RPC

THE agreement between members of the Permanent Magnet Association was the subject of a hearing before the Restrictive Practices Court which began in London on Monday. The Court was asked to decide whether the agreement, which is said to include price fixing, is against the public interest. In opening the Association's case, Mr Roche explained that one of the reasons the members joined together was that patent proceedings were expensive. If a patent was obtained to make an invention, and a manufacturer applied for patents in foreign countries, these countries did not always take the same view about patents. In this matter there might be a serious disadvantage if the rival was an international concern.

## METHOD STUDY IN MINING

METHOD study techniques are being widely applied by the NCB to increase efficiency of mining. An exhibition is being held at the Board's London headquarters to show the scope of activity in this field, and the Board have published a brochure "Method Study in the Mine" which describes simply the procedures and results of method study.

## N.W.E.B. display winner

"KEEPING Warm" was the theme of this year's window display competition of the North Western Electricity Board, which was won by the Stockport Service Centre—a team effort by the centre's staff. There were 107 entries, a record. The winning display, shown below, made clever use of colour and design, its main feature being a fortune-teller gazing into a crystal and foretelling "secrets for winter warmth." The display included a variety of electric heating appliances. Wigan and Lytham service centres tied for second place. Both first and second place winners led, of course, in sub-area judging, and other sub-area winners were Longsight, Rochdale and Dalton.

## Switchboards for Trawsfynydd

**Construction and wiring of combined contactor/fused switch control boards for Trawsfynydd nuclear power station occupies the whole of one assembly shop of the East Moulscoomb works of Allen West & Co. who are supplying nearly all the l.v. control gear for the station. Here is seen wiring in progress on part of the reactor 1 d.c. board which is over 76½ ft long**

# INDIA SEEKS £6,000m FOREIGN AID

### Tata chief outlines plan at E.I. Club Luncheon

AN idea of the staggering level of foreign aid India expects to receive in its third Five-Year Plan, just beginning, was given by Sir Frederick James when he addressed the Electrical Industries Club luncheon last week. After referring to the success of the first two Five-Year Plans, Sir Frederick, who is deputy chairman and managing director of the great Tata steelworks, said the new plan would require a capital investment of approximately £8,000 million, of which 75% would be derived from foreign aid. Of the amount received from private sources, 65% would come from this country.

Following the vote of thanks to the guest speaker by the president, Mr E. A. V. Peckham, it was announced that the next meeting on 12 Dec. would be a special Christmas luncheon, at which the guest speaker would be Mr Bernard Miles, of Mermaid Theatre fame.

## *Rank looks at lighting*

A COLOURFUL ten-minute survey of lighting today was released by Rank Film Distributors last week. This film is the latest edition in the "Look at Life" series, which are made with the general public very much in mind and shown at cinemas all over the country. Entitled "Lights Up," the film stresses the need for better lighting in places of work and draws amusing comparisons between the old and the new. Design and manufacture of tungsten and fluorescent lamps are shown with an effective and well-informed background commentary.

## Inventions Exhibition in February

SPONSORED by the Institute of Patentees and Inventors, the International Inventions and Commercial Development Exhibition is to be held at the Central Hall, Westminster, S.W.1, from 16 Feb. to 24 Feb. next. The exhibition is open to participation by the Institute's members and by commercial firms who are developing new patents and improvements to existing products. The exhibition will be open to trade buyers only in the mornings and to the general public in the afternoons and evenings. Organisers are: Empson and Turner, Thorn Hse, Upper St. Martin's La, W.C.2.

**The "Secrets for Winter Warmth" as given by the fortune teller in Stockport's winning window display in the NWEB contest**

## *Amplified Urgency*

EXPERIMENTS with warning devices for emergency service vehicles in traffic have shown that bells are more distinct at a given level of sound intensity than other sounds. For this reason the Minister of Transport told the House of Commons that he thinks an amplified bell is likely to be most satisfactory on ambulances than other methods such as sirens. However, preparations were being made to permit the use of sirens on ambulances if ambulance authorities desire them.

# Changes in H.P. Law Suggested by Consumer Council

RESEMBLING a shorn lamb in untempered winds, the hire-purchase consumer is at least finding a number of willing protectors just now. Latest move comes from the BSI's Consumer Advisory Council, who have sent a list of proposals for the reform of hire-purchase law to the Finance Houses Association. The Council suggest that all hire-purchase firms should be licensed by the BoT and that finance houses should not offer commission to dealers.

Coinciding with recently expressed Conservative and Labour views, they also believe there should be an escape period, say, 48 hr, during which either party could cancel the contract, and that minimum deposits should be set. They go a little further in saying that maximum interest rates "could well be laid down by law, as in Australia."

It would not be surprising if the finance house which last week reported a further £1 million loss from bad debts agreed with some of these ideas. In any event, the Finance Houses Association have just issued a pamphlet for the public's guidance listing three golden rules, with number one being to buy only one item at a time on hire-purchase. The others are: base purchases on normal salary, not bonuses, and pay down as much as you can afford. Like the Consumer Advisory Council, they consider 25% about right for a new car, so it looks as if some parts at least of the private member's Bill which a Labour MP will introduce this session will have an easy passage.

## Government Tenders

THE Chancellor of the Exchequer was asked in the Commons last week if he would direct Government Departments and boards of nationalised industries to publish the names of firms when tenders were invited. He was also asked that the totals of each tender should be published. The Financial Secretary said that the practice of nationalised industries in this matter was the responsibility of the individual boards. With regard to Government Departments, the Chancellor was not prepared to issue a general direction on the matter.

## Gas/Steam Turbine Frigate Commissioned

HMS *Ashanti*, first of the new Tribal Class frigates for the Royal Navy, which was handed over by the builders, Yarrow and Co., of Scotstoun, recently, has novel propulsion equipment in that it combines both steam turbine and gas turbine boost on a principle developed conjointly by the Yarrow-Admiralty Research Departments and made by AEI.

The steam turbine provides power for normal cruising and manoeuvring but, for high speeds and rapid getaway when steam is not immediately available, an AEI 06 gas turbine, geared to each propeller shaft, provides an additional 7,500 s.h.p. at a few moments' notice. The 06 is a "free spool" turbine, the blading driving the 13-stage axial flow compressor being separate from that driving the output shaft. It runs on distillate fuel but heavy oil fuel can be used in an emergency.

This is the first of a number of such marine installations and AEI have four sets of propulsion machinery under construction.

## Sunbeam buy into Garden Equipment

SUNBEAM Electric Ltd. are branching out into the manufacture of electric fencers, hedge-trimmers and animal clippers, through the purchase of the Lawn Care and Agricultural Equipment Division of Cooper-Stewart Engineering Co. Ltd. Manufacture of these products will be transferred from Cooper-Stewart's premises at Letchworth to Sunbeam's factory at East Kilbride, Glasgow, and the stock and machinery are now being moved.

Cooper-Stewart, who have previously been agents for the parent Sunbeam company in Chicago, will now concentrate solely on the manufacture of compressors and exhausters, and will henceforth trade under the name Cooper Compressors Ltd.

## PRICE MORE IMPORTANT THAN QUALITY

IT is necessary to be 5% on the right side in prices whatever the quality you offer, said Dr J. A. Pope when speaking at the IEE East Midlands Centre annual dinner in Nottingham last Friday. Dr Pope, research director of Mirrlees' National Research Division, told his listeners that there was a great need for first-class designers. He felt that the universities spent too much time on the analysis side and not enough time on the judgment side. This led to difficulty in getting new graduates interested in design.

Industry had to stop looking on planning as a dirty word, he said, because it was difficult to see how Britain could be competitive in the future unless there was some kind of planning. Dr Pope suggested that all professional groups mainly interested in qualifications should take a much more active interest in technological education.

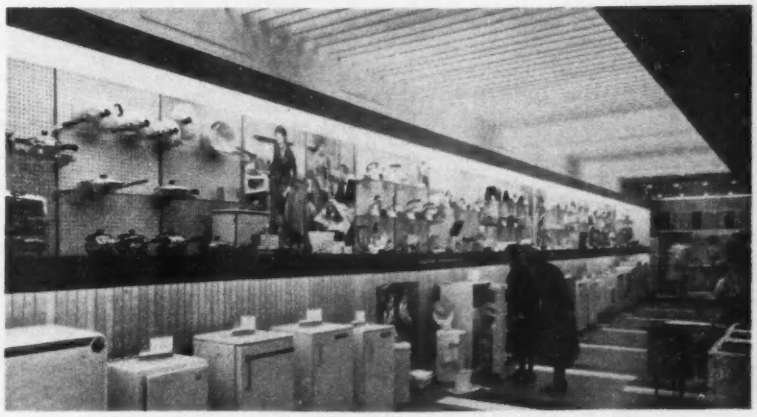
He remarked on the important part which was played by the Royal Society in the scientific field and he felt that the civil, mechanical and electrical bodies had nothing like the same influence.

Mr J. G. McMeeking, chairman of the Regional Advisory Council for Further Education in the East Midlands, paid tribute to the fine record of electrical engineering firms in the day-release of young workers; 80% were given the privilege in this industry, whereas the figure in commerce was only 7%.

Other speakers were the centre's chairman, Professor J. E. Parton; the Lord Mayor of Nottingham, Alderman J. Llewellyn Davies; Mr C. E. Strong, honorary treasurer of the IEE; and Mr O. S. Woods, vice-chairman of the centre.

## Remodelled Showroom

LATEST of LEB's showrooms to be remodelled is the one in Lavender Hill, Battersea, shown below. Lighting load for the 2,700 sq ft amounts to 30 kW, but glare is avoided by the use of white baffle board in the ceiling and the effect is light and airy. Another feature of the showroom is an unusually comprehensive display of small appliances.



## E.T.U. Rules Conference Proceeds

HELD up pending the result of an application for a High Court injunction, the Rules Revision Conference of the Electrical Trades' Union began at Hastings this week after Mr Justice Pennycuick ruled on Tuesday that upon the evidence submitted he had no right to interfere with the holding of the conference. Mr F. Chapple alleged that there had been irregularities in the election of some of the delegates to the conference.

The action in which Mr Chapple asks that decisions made at that conference be declared null and void will go on and will be heard at a later date.

## £21 PUBLIC RELATIONS COURSE OFFERED

A LONDON public relations firm, Andrew Bainbridge and Associates, plan to hold a three-day practical course in public relations designed especially for electrical retailers and manufacturers from 9-11 Jan. Fee for the course is £21 and the full complement is 10, though these need not necessarily be high executives.

The principal of the firm, Mr Andrew Bainbridge, told the ELECTRICAL TIMES that he had been in touch with several manufacturers concerning the course, but not as yet BEAMA or any other trade associations. Since October, a number of fully booked general courses had been held, but this was the first to be orientated to a particular industry. The method of working is to pose a problem or situation, and then for the participants to go to work on it. "There are no lectures," said Mr Bainbridge, "they only send people to sleep." The course will be held at the Green Park Hotel, Mayfair.

## *Sayings* OF THE WEEK

*"In 1955 you could perhaps get three or four electronic components in a cubic inch. In 1961 we can get about 150 . . . and in 1967 we shall probably be able to get 18,000 in a square inch."* . . . VISCOUNT CALDECOTE, speaking in the House of Lords.

*"They beat us—but we won."* . . . MR F. FOULKES, chairman of the union side of the NJIC, after conclusion of electricity pay agreement last Thursday.

*"Electrical kitchen equipment is rapidly becoming a series of boxes. One cannot tell which unit is which except for the handle. If this trend continues we shall be putting the joint in the washer and the washing in the refrigerator."* . . . MISS P. J. THOMPSON, of the EAW, speaking at Croydon.

## PRICES of cable metals and other materials

*Figures quoted are the official prices ruling on Tuesday, November 21*

| | £ per ton | Weekly change £ |
|---|---|---|
| COPPER, standard class A (settlement) ... | 229½ | +1½ |
| " (3 months) ... ... | 228½ | +1 |
| LEAD, refined pig, 99·97% purity (cash) ... ... ... | 59½ | +1½ |
| " (3 months) ... ... ... | 60½ | +1½ |
| TIN, refined, min. 99·75% purity (settlement) ... ... | 961 | −1½ |
| (3 months) ... ... ... | 968 | +1 |
| ALUMINIUM, ingots 99-99·5% ... | 186 | — |
| " wire bars (4×4×54") | 193½ | — |
| BRASS Strip 63/37 ... ... ... | 195½ | — |
| SILVER (Troy oz) ... ... ... | 80d | — |

| | £ per ton | Weekly change £ |
|---|---|---|
| ZINC, virgin, min. 98% purity (cash) ... ... ... | 68½ | +⅜ |
| " (3 months) ... ... ... | 69½ | +⅜ |
| RUBBER, per lb | | |
| No. 1, RSS, spot ... ... | 22⅜d | +⅛d |
| c.i.f. basis, ports, Jan. ... | 22⅛d | — |
| ARMOURING: | | |
| Galv. Steel Wire (0·104 in.) ... | 68½ | — |
| Mild Steel Tape (0·04 in.) ... | 53½* | — |
| NICKEL (home) ... ... ... | 660 | — |
| MERCURY (76 lb flask) ... ... | 59 | −1 |
| AMERICAN PRICES: | | |
| Copper, electrolytic (per lb) ... | 31c | — |
| Lead (New York) ... ... | 10c | — |

* *Tape Price, now on average, includes varnishing*

## LARGE CONTRACTS AWARDED

FOR driving standby boiler feed pumps at Ferrybridge "C," one of the two 2,000 MW stations being erected in Yorkshire, the Heavy Plant Division of AEI is to supply eight 9,500 h.p., 11 kV motors of the variable-speed slip-ring induction type. They will be controlled by liquid rotor regulators over a speed range of 965 r.p.m. to 725 r.p.m., speed variation being necessary to match the water supply of the boilers to the steam demand of the main turbines. Worth more than £400,000, the motors will be made at Trafford Pk by 1965-67.

ANOTHER new order for AEI's Heavy Plant Division, this time to be fulfilled by the Rugby and Manchester works combined, concerns a diesel-electric dredger to be built for the Blyth Harbour Commission by Simons-Lobnitz of Renfrew. AEI are to supply the propulsion machinery and auxiliary electrical equipment, including the two 600 s.h.p., 250 rev/min motors which will drive the main propellers, and the two 550 kW, 750 rev/min generators.

A £A180,000 order which GEC (Engineering) Ltd. have received from Australia is for a winder to be installed in Oakdale State coal mine during the Christmas, 1962, holiday. The winder, of the double drum, single clutch, and geared type, will be used to raise 500 tons of coal an hour from a 1,350 ft vertical shaft. It will be driven by a 2,400 h.p., 470 rev/min d.c. motor and will be equipped with the GEC positive oil-pressure operated braking system.

GEC (Engineering) Ltd. have also received two orders for remote handling equipment, one from the Danish Atomic Energy Commission worth £16,454, and the other from the Swiss Federal Office of Works valued at £23,844. Both orders include a standard GEC Mk I power manipulator with a lifting capacity of 750 lb and a 1½-ton hoist unit.

THREE orders for crane controls and lifting magnets for steelworks have been placed with Brookhirst Igranic. Sir Wm. Arrol has ordered 14 sets of a.c. crane controls for English Steel's new Tinsley Pk works; Babcock and Wilcox have ordered two d.c. crane equipments and ten lifting magnets for South Durham Steel and Iron's 20-ton overhead cranes; while the third order covers 13 heavy duty electro-magnets for the Spencer steelworks of Richard Thomas and Baldwins.

IN the communications-TV sphere, Elliott Bros. (London) Ltd. have received a £100,000 order from the Home Office for u.h.f. radio link terminals for a new Civil Defence network. For Radio Eireann's TV, Pye Ireland has been awarded a £175,000 contract to supply four 625-line transmitters. For the first time at two of the stations, a unique "combining unit" will be used to allow radiation of 405-line and 625-line programmes simultaneously from a dual standard aerial.

THEIR third order from the BTC for main line locomotives in two months, Brush Electrical are to supply a further 27 Type 2 diesel electric locomotives. They will be powered with 1,365 b.h.p. Mirrlees JVST 12-cylinder diesels. This order brings Brush's total for main line locomotives for British Railways to 263, of which more than 220 are already in service.

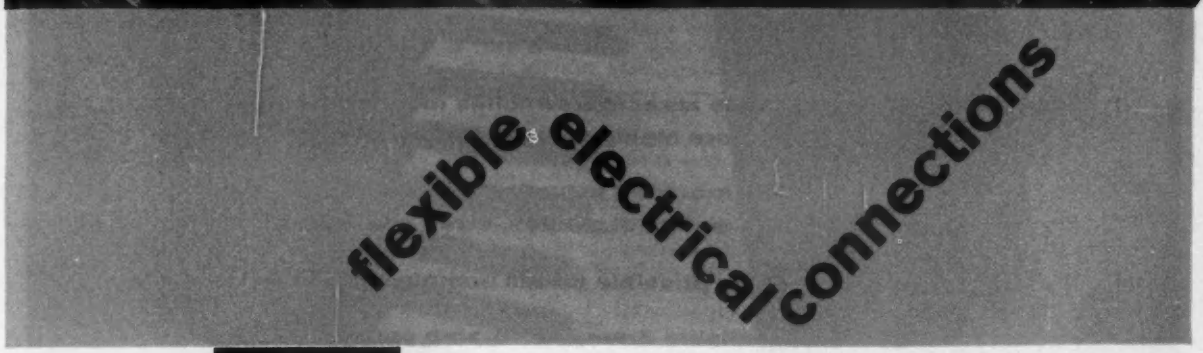
## News in Brief

"Yell for Light—for Yell" is the slogan adopted for a campaign seeking to get the North of Scotland Hydro-Electric Board to provide a public electricity supply for the island of Yell, the second largest of the Shetlands.

To commemorate the 25 years of service of Fulham power station, the South Eastern Region, CEGB, have issued a 32-page brochure outlining its history and development.

A portable transistorised direction-finding device suitable for use by a blind person has been evolved at the Birmingham University Department of Electrical Engineering.

Eastern Electricity Board held a three-day domestic heating exhibition at Bedford Corn Exchange.

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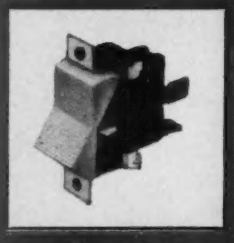
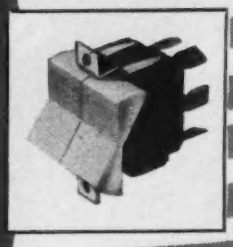
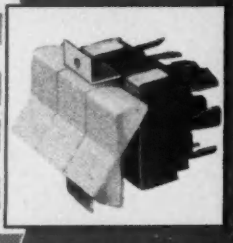

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*Write for Bulletin 11*

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# Company Activities

ONE almost suspects that the stock market is having its leg pulled—and hard! The chief leg puller being Mr Selwyn Lloyd, of course. For it seems that the Chancellor has these days to do little more than smile—and the stock market is off at the gallop. Last week saw the publication of worsened trade figures for October, a continuing stream of unhappy company news and figures which strongly indicate that the Government's restrictive measures are now tightening upon the throat of retail trade. But the Chancellor had only to tell the National Union of Manufacturers that world conditions were favourable to an increase in UK exports and with all the glee in the world equities were bouncing by the shilling higher.

What are the facts? The facts are that the seasonally adjusted trade gap for October, at £56 million, was the biggest since last May, the figure compares with an average trade gap of £49 million for the January to October period and, what is extremely significant, the October deterioration was due mainly to a renewed rise in imports. If world conditions are favourable to an increase in UK exports, they are also favourable to an increase in other countries' exports to the UK!

Much of the Chancellor's hope for an increase in UK exports is pinned upon greater imports by the out-of-recession US. But although Wall St was last week pipping new peaks, there is increasing disappointment over there that the boom has not boomed with more zoom, businessmen are holding back on capital outlays and there is widespread despondency that what boom there has been has not increased the profit margins of US corporations. And this is a deterrent to capital spending.

Last week, however, the market seemed quite prepared to shrug aside all these considerations, to the extent that the *Financial Times* industrial ordinary index blazed up from 299·7 to 308·3, before falling back to 306·8. Let us just say that time will show whether the market is riding for a fall or not.

Meanwhile, the electrical market joins the general joy-ride. "Heavyweights" AEI, GEC and English Electric all took a turn for the better. EMI, taking its cue from Wall St where a large amount of the stock is held, waltzed up from 38s 6d to 44s before tripping back to 42s 6d, and Thorn charged up from 56s to 59s 6d. ICT leapt from 91s 6d to 96s 9d and Astaron Electronics starred with its dizzy climb from 21s 3d to 26s 9d after 27s 6d, while Berry's raced up from 60s 3d to touch an all-time high of 64s.

For the electrical market there were also one or two more encouraging items of company news. From Sir Charles Westlake of Metal Industries came word that most of their manufacturing subsidiaries are still working at full pressure and many of them have plenty of orders on hand. Pre-tax trading profits for the half-year to 1 Oct. were also announced at £1,183,000 and compared with £1,082,000 for the first six months of last year. Thus the interim has been maintained at 6%, and so satisfactory did the market consider the affairs of Metal Industries that the shares were marked up from 49s 9d to 52s 4½d after 53s 4½d.

*—From our City Correspondent.*

## Aberdare Cables Africa

The policy of this South African company, controlled by Nederlandsche Kabelfabrieken of Delft, of buying raw materials locally, even at prices above the world level, "hampers the full development of our possibilities for the moment" says the chairman, Mr C. von Lindera, in the annual report. Even so, trading profit was lifted from R180,144 to R336,554.

## Charles Colston Ltd.

Within a few days of the launching of the joint company with Rolls Razor to produce direct-sale dishwashers, the original Colston firm are lifting paid capital from £565,000 to £650,000 "to finance expanding business and open up new markets abroad."

## Contactor Switchgear

The 46% recovery in trading profit for the year to July looks even better now that the chairman discloses that the rise in output was 27%. No such dramatic advance is looked for this year. The order book is in good shape, but competition is becoming even more intense.

## Crompton Parkinson

Record profits and turnover last year, during a period of consolidation at home and abroad, so what of the future? The transformer industry, says Mr A. Parkinson in his report, has still not attained stability either in satisfactory price levels or in the flow of orders, in cable prices there is some but not sufficient improvement, and traction business has been upset by the Government. Overall, however, the order position is good, but margins are expected to be lower and last year's consistency of demand is not expected to be repeated. On the Common Market, Mr Parkinson takes a cautious line. Links with the Commonwealth should not suffer, he feels.

| Year to 30 June | £ Trading Profit | £ Net Profit to Parent | % on Ord. Earned | % on Ord. Paid | Ord. Price* High | Ord. Price* Low |
|---|---|---|---|---|---|---|
| 1957 | 2,927,965 | 1,079,564 | 47.4 | 16 | 11/11 | 9/1 |
| 1958 | 3,134,149 | 1,134,715 | 33.2 | †12 | 14/1 | 8/3 |
| 1959 | 3,249,465 | 1,266,388 | 34.9 | 14 | 15/6 | 9/5 |
| 1960 | 3,293,051 | 1,228,125 | 27.0 | ‡12½ | 15/7 | 10/5 |
| 1961 | 3,646,000 | 1,321,000 | 29.1 | 12½ | 15/- | 11/- |

* Calendar year, except 1961, which is up to 4 Oct.
† After 1-for-2 scrip issue. ‡ After 1-for-4 scrip issue

## Dowding and Mills

Profit for the first four months of the current year shows a further slight increase on last year's record level, according to the report with the accounts. Permission to extend the London works is still being sought.

## Electrical Apparatus Co.

The group's strong recovery in the year to 31 July from trading profit of £273,443 to £353,893 is not dimmed by excluding the earnings of the three subsidiaries acquired nine months earlier. These subsidiaries, Interohm, Process Control Gear, and Switchboards, all did well and contributed £16,000, directors disclose in their report. The group's factories continue to be well employed and orders are still coming in satisfactorily.

## Metal Industries

Continuing his policy of keeping his shareholders posted, Sir Charles Westlake reports that trading profit moved up to £1,183,000 for the 26 weeks to 1 Oct., compared with £1,082,000 in the previous corresponding period. There has been "little alteration" in trading conditions, he states, which shows that the upward trend already reported for the first four months of the latest half-year continued in August and September. Most of the manufacturing subsidiaries are still working at full pressure, but new business is proving harder to get, and interim dividend stays at 6%.

## Philips' Lamps

A note of disappointment is discernible in the latest quarterly report. Sales for the first nine months of 1961 are 2% above the corresponding period of 1960, but this is not up to budget.

## Sun Electrical

The rationale of the recent takeover of H. W. Gilbert Ltd., of Brentwood, is explained in the annual report. The new subsidiary opens up an area of business in which Sun have not previously had stocking and transport facilities.

## Tube Investments

The group's £3 million rise in earnings and 20% in turnover was in no way due to the Electrical Div., chairman Sir Ivan Stedeford reveals in his review of the year to 31 July. Results in this sector were "less rewarding" to the extent that earnings were small even though turnover increased by 7½%. The industrial side is improving steadily, but Sir Ivan declines to forecast an early return to normal trading in the domestic appliance business.

## Dividend Announced

*Ward and Goldstone.* Interim 5% (*same*).

# OVERSEAS NEWS

from our correspondents abroad

## CANADA

### Multi-purpose Scheme

An irrigation and water power scheme to utilise the resources of the James Bay area was put forward at the "Resources for Tomorrow" conference at Montreal a few days ago. The three major watersheds on the North American Continent are: James Bay, Great Lakes and the Mississippi. Approximately ten rivers from the James Bay watershed, on the Quebec side, flow from the "Height-of-land" into the bay, providing a potential of 8,000,000 h.p. From the "Height-of-land," the Great Lakes system flows downward into the Mississippi region. From sea level at James Bay, to 950 ft above sea level and down to 603 ft (Lake Superior) and eventually to sea level again in the Gulf of Mexico is an area known to be suffering from a severe lack of water and water power. This project proposes to harness a portion of the northern rivers, divert the flow of the Harricanaw River, and reverse it from "Height-of-land," into the Great Lakes system by means of pumps powered by generating plants on the other rivers. Estimated cost of the initial stage is between $150 million and $200 million.

### Settling Day

British Columbia and the Federal Government will settle their differences over the sale of Columbia River downstream power benefits by next March, Justice Minister E. D. Fulton predicted recently. This followed the statement by the chairman of the American section of the International Joint Commission, who said it would not be reasonable to expect delay on ratification of the treaty beyond next March.

## W. INDIES

### Expansion Continues

The recent considerable expansion by the Barbados Light and Power Co. Ltd. continued in the year ended 30 June last with a further 2,168 consumers connected, bringing the total to 21,147, and the company now supplies to one out of every three houses on the island. A further generating set was installed, raising the total capacity to 12,890 kVA, but the maximum demand only reached 7,550 kVA. The company's 11 kV connection to the Bridgetown Harbour area has been completed, to enable several large commercial undertakings to take a high voltage supply. The total additional h.t. load connected was 3,650 kVA.

## NORWAY

### Generator for Tokke

Claimed to be the largest waterwheel generator yet to be manufactured in Great Britain, a 140,000 kVA, 300 r.p.m. 17 kV machine has been ordered from Associated Electrical Industries Ltd., by the Norwegian State Power Authority, Norges Vassdrags—og Elektrisitetsvesen. The set is for operation with a 150,000 h.p. vertical Francis water turbine in Tokke III station. The machine is to be delivered by the end of 1963.

## SWEDEN

### Nuclear Recommendation

The proposed 105 MW nuclear power station at Marviken should be undertaken as the logical next step in Sweden's nuclear energy programme, in the view of the special committee which has just reported to Parliament on the matter. We reported on 14 Sept. that the State Power Board were unconvinced of the economic case for the project at the present time, whereas AB Atomenergi considered that it was not meant initially to be an economic proposition, but urged that it should be built to come into operation around 1967. The special committee have accepted the latter side of the argument, and have recommended the Government to build the station as currently planned for operation in 1967-68.

## GHANA

### Ready for Royal Visit

Working round the clock at the urgent request of the Ghana Government, Mirrlees and Brush engineers commissioned three of the ten 3,000 kW diesel generating sets at the new power station at Tema on 7 Nov., in time to meet the additional power demands caused by the visit of HM The Queen and The Duke of Edinburgh last Friday. These sets were completed several weeks ahead of schedule. Tema power station and substations are being built under a £3 million contract by a consortium of three British companies—Parkinson Howard, BICC, and Hawker Siddeley Industries, who is the main contractor.

## S. AFRICA

### HE Proposals

The engineering consultant of the World Bank, South African-born Dr Henry Olivier, has stated that South Africa could profitably embark on hydro-electric schemes on the Orange, Vaal and Tugela-Pongola River systems, and that these would assist the establishment of industries on the borders of the Bantu homelands. He envisaged a system of multi-purpose dams similar to the Snowy River hydro-electric development in Australia and estimated the potential of the Orange River as four or five projects developing at least 1,000 MW. Three possible dam sites in the Transkei alone could provide nearly as much electricity as the entire Natal production, he said.

## PAKISTAN

### Mangla Dam Tenders

Opened publicly in London last week at the request of the World Bank, four tenders for the main civil engineering work for the Mangla dam project, West Pakistan, had been submitted by groups representing some 25 firms. The lowest price quoted, of nearly £126·4 million, was put forward by the Guy F. Atkinson consortium, comprising seven USA firms. The second lowest bid, of £134 million, was received from the Morrison-Knudsen consortium of nine companies, which include John Laing and George Wimpey. The project will include a dam some 10,000 ft long, plus two other dams, spillway structure, five tunnels, the power station and a canal three miles long. The power station will have an initial capacity of 300 MW, rising ultimately to 1,000 MW. Various aspects of all the tenders have yet to be studied, and it is anticipated that the Water and Power Development Authority of West Pakistan will announce the award of the contract probably next January.

### Distribution Renewal

Two schemes prepared by the Water and Power Development Authority, costing Rs67 crore, for rural electrification and improvement of the distribution system, have been approved by Pakistan's central government, Mr Ghulam Ishaq, chairman of the Authority, stated in Lahore earlier this month. But he emphasised that the availability of foreign exchange was hindering the implementation of the work. Of the total sum, Rs32 crore is for rural electrification, and Rs35 crore for the distribution project, both to be completed in five years. He said WAPDA would shortly embark upon a Rs2·25 crore plan to renovate the power supply system in eight big cities in the province. The scheme would be implemented on the completion of necessary aerial and other surveys. The assistance of DLF would also be sought in the implementation of the scheme. It was hoped to complete the renovation by 1964. On the question of power failures, he said there had been a lack of planning in the running of lines, while unauthorised connections also added to the problem. Another factor which contributed to the number of breakdowns was the burning out of certain transformers. These transformers, which

were of sub-standard quality had been inherited by WAPDA and the purchasing agencies had not been well advised in purchasing certain material.

## INDIA

### Supply Situation

From a reappraisal of India's various development schemes, the Planning Commission now considers that 1963 and 1964 will be crisis periods in respect of both electric power and transport capacity, we learn. A shortage of both is now considered unavoidable, with the industrial belt in West Bengal and Bihar, parts of Andbra, Bangalore, Mysore and Delhi being the areas likely to be hardest hit. It seems that the Commission realises the coming crisis cannot be averted, and has taken certain decisions to mitigate the situation as far as possible. There is also an indication that private industrial concerns may be permitted to install generating plant for their own use where the necessary foreign exchange is available.

## SINGAPORE

### New Station Project

The establishment of a new generating station with an initial capacity of 60 MW is provided for under the current Singapore Development Plan. Work would be expected to start within the next year or two, but so far no definite plans have been prepared. The first step is the appointment of a firm of consulting engineers, and the chief electrical engineer has recently visited several countries in this connection, including America, where he also had discussions with World Bank officials. On previous power station projects for the City Council, Preece, Cardew and Rider have acted as consultants. The last generating plant ordered by the City Council was the 36 MW of free-piston-engined power, comprising six 6 MW sets, which were placed in the old St. James power station building, but we understand that these are not yet in commission.

## AUSTRALIA

### Reduced Surplus

Preliminary details of operations of the State Electricity Commission of Victoria in the year 1960-61 show that the surplus dropped to £220,000, compared with £460,000 in the previous year. Sales of electricity increased by 8% to 5,296 million units, and briquette sales rose by 34% to 861,000 tons. According to Mr W. H. Connolly, the chairman, the growth of electricity sales had been checked considerably by the damping down of industrial and commercial activity in Victoria following the ecomonic measures last November. The unusually mild autumn, winter and spring had also contributed to the small increase in growth.

# Glen Canyon Project Taking Shape

Below is an aerial view of Glen Canyon dam, now taking shape on the Colorado River, Arizona. The dam, now more than half-way completed, is to be 700 ft high above its foundation, with a crest length of 1,500 ft—being second in height in the USA only to the 726 ft high Hoover dam, which is some 370 miles downstream. It will form a 28 million acre ft reservoir, extending 186 miles up the Colorado River and 71 miles upstream on the San Juan River. The power station, being built about 470 ft downstream from the axis of the dam, will have an installed capacity of 900 MW. It will be recalled that the order for the eight 155,000 h.p. water turbines was awarded to Baldwin-Lima-Hamilton, of Philadelphia, whose bid, including 42·7% of imported material from Belgium, was just a little below that of the English Electric Co. Throughout most of its 176-mile length, Glen Canyon is a narrow river gorge confined by massive sandstone walls which vary in height to a maximum of 1,200 ft above river level. At the dam site those walls rise almost vertically to a height of 650 ft.

# COMMERCIAL INFORMATION

## Contracts Open at Home . . .

*Dates given are the final for receipt of tenders unless otherwise stated.*

**23 Nov.—Luton.** Electrical installation in Transport Garage Central Depot, Portland Rd. Borough Architect, Town Hall. Closing time 12 noon.

**24 Nov.—Hereford C.C.** Electrical installations in 74 houses No. 6 site and 72 houses No. 7 site, Newton Farm.—Advertised 26 Oct. issue.

**24 Nov.—Longbenton U.D.C.** Supply and erection of 164 concrete post-top lantern filament lighting units.—See 9 Nov. issue.

**24 Nov.—Manchester C.C.** Supply of: 64 G.E.C. 25569B top entry lanterns; 93 chokes for 80 W h.p.m.v. lighting; 93 capacitors and 93 Sangamo Weston time-switches, type S.251.—See 16 Nov. issue.

**24 Nov.—Swansea C.B.C.** Electrical installation in Hall of Residence, Swansea Training College.—See 16 Nov. issue.

**27 Nov.—Billingham U.D.C.** (Contract 1.) Supply of 104 concrete columns; (2) supply of 115 140 W sodium lanterns; (3) erection of columns/lanterns.—See 16 Nov. issue.

**27 Nov.—Dearne U.D.C.** Supply and erection of 165 Stanton 10F street lighting columns, together with ancilliary equipment. Engineer and Surveyor, Council Offices, Bolton-on-Dearne.

**27 Nov.—Hemel Hempstead B.C.** Electrical installation in Warners End neighbourhood centre. Borough Engineer, High St.

**27 Nov.—Kirkcaldy B.C.** Supply and installation of 400 cookers and 200 washboilers. —See 9 Nov. issue.

**27 Nov.—Linlithgow B.C.** Erection of 37 Class "B" steel columns and supply/erection of lanterns/lamps/gear.—See 9 Nov. issue.

**27 Nov.—Strabane.** Electrical installation in new office building for Ministry of Finance. —See 16 Nov. issue.

**27 Nov.—Worksop B.C.** Scheme involving 217 60 W sodium lighting on 15 ft concrete columns: (1) Supply of lanterns/lamps/gear; (2) removal of existing lighting and supply of columns together with wiring and fitting of equipment; (3) whole of work.—Advertised 2 Nov. issue.

**28 Nov.—Dartford B.C.** 15 15 ft steel columns and mercury lamps/lanterns on Temple Hill (Site 2c).—See 2 Nov. issue.

**28 Nov.—Dartford B.C.** 26 25 ft reinforced concrete columns and 400 W MBF/U lamps/lanterns along Watling St.—See 2 Nov. issue.

**29 Nov.—Ayr B.C.** Supply of 5,000 yd 7/·036 p.i.l.c.s.w.a. juted 1·1 kV cable. Town Clerk: R. C. Brown, Town Bldg.

**29 Nov.—Castlereagh R.D.C.** Supply and erection of 15 fluorescent lanterns and concrete columns at Glencraig Rd, Craigvad. Council Offices, 368 Cregagh Rd, Belfast 6. Deposit £3.

**29 Nov.—Durham C.C.** Electrical installation in Dunston R.C. (Aided) School. Applications to County Architect, South St, Durham, by above date.

**30 Nov.—Cardiff C.C.** Electrical installation, on fixed-price basis, in proposed Fairwater Primary School, Pentrebane Rd.—See 9 Nov. issue.

**2 Dec.—Barrhead B.C.** Rewiring of 384 houses.—See 16 Nov. issue.

**2 Dec.—Huyton-with-Roby U.D.C.** Tender No. 12. Supply of public lighting equipment for year to 31 March, 1963. Applications to Engineer and Surveyor, Council Offices, Derby Rd, Huyton, by above date.

**4 Dec.—Depwade R.D.C.** Provision and installation of water heaters with plumbing services in 22 bungalows. Engineer and Surveyor, Council Depot, Long Stratton, Norwich. Deposit £3 3s.

**4 Dec.—Edinburgh.** Electrical maintenance work in City Hospital, Royal Victoria Hospital and Southfield Hospital, Edinburgh, and in Loanhead Hospital, Midlothian, for year to 31 Dec., 1962. Secretary and Treasurer: A. G. Welstead, Edinburgh Royal Victoria and Associated Hospitals Board of Management, City Hospital, Greenbank Dr, Edinburgh 10.

**4 Dec.—Hastings C.B.C.** Electrical installation in new grammar school, Parkstone Rd. Applications to Borough Surveyor: E. O. Baxter, 37 Wellington Sq, by above date. Deposit £3 3s.—Advertised in this issue.

**4 Dec.—Kincardine C.C.** Electrical work in Glenbervie Primary School alterations and additions.—See 16 Nov. issue.

**4 Dec.—Petersfield R.D.C.** Supply and erection of Group "A" lighting: (1) 36 columns/one bracket with 140 W sodium lanterns/gear and wiring along London Rd, Liphook; (2) 36 columns with 140 W sodium lighting along London and Portsmouth roads, Horndean.—See 9 Nov. issue.

**5 Dec.—Bentley-with-Arksey U.D.C.** Electrical installations in 37 bungalows at Pipering La, Scawthorpe. Surveyor, Council Offices, Bentley, Doncaster. Deposit £1 1s. Registered contractors only.

**5 Dec.—Leeds C.C.** Supply and erection of 30 g.p.m. at 165 ft head booster pumping plant, complete with switchgear, motors, etc.—See 9 Nov. issue.

**6 Dec.—Hoylake U.D.C.** Supply of 1,700 solar dial time-switches for street lighting.—Advertised 16 Nov. issue.

**6 Dec.—Skelton and Brotton U.D.C.** Electrical installations in 56 houses and bungalows on Marske La housing estate. Surveyor, Council Offices, Skelton.

**7 Dec.—Dundee Harbour Trust.** Supply and erection of three level luffing travelling cranes of the portal type.—See 9 Nov. issue.

**8 Dec.—Potters Bar U.D.C.** Rewiring of 50 houses in Cranbourne Rd. Engineer and Surveyor, Wyllyotts Manor, Darkes Lane. Deposit £2 2s.—Advertised in this issue.

**9 Dec.—Seaton Valley U.D.C.** Electrical installations in 32 houses at Seghill.—See 16 Nov. issue.

**11 Dec.—Chelmsford B.C.** Provision and erection, on fixed-price basis, of 107 Group "B" columns, lanterns and gear in St. John's Rd area. Borough Engineer and Surveyor, Coval La. Deposit £2 2s.

**11 Dec.—Darlington B.C.** Electrical installations in 46 houses on Firth Moor estate. Borough Architect, E. A. Tornbolm, Central Bldgs.

**11 Dec.—Wallasey C.B.C.** Electrical installations in three blocks of five-storey flats and maisonnettes. Borough Architect, Town Hall.

**13 Dec.—Keynsham U.D.C.** Provision and installation of two 180 g.p.m. sewage pumps with motors for Norman Rd housing estate. —See 16 Nov. issue.

**15 Dec.—Leeds C.C.** Trunk road and roundabout lighting: (Contract 3A) supply of 11 35 ft reinforced concrete columns/brackets; (3B) supply of 11 200 W sodium lamps/lanterns/gear; (4A) supply of 26 25 ft reinforced concrete columns/brackets; (4B) supply of 140 W sodium lamps/lanterns/gear. City Lighting Engineer, Springwell St, Leeds 12.

**16 Dec.—Girvan B.C.** Supply and fitting of electrical striking movement for town steeple clock and for the replacement of the south dial. Town Clerk: J. H. Cunningham, Hamilton St.

**16 Dec.—Plympton St. Mary R.D.C.** Installation of 75 street lighting columns and 80 W m.v. control gear at Stentaway estate, Plymstock. Engineer and Surveyor, Council Offices. Deposit £2 2s.

**18 Dec.—E.B. for N.I.** Specification 1642. Lighting and heating associated with No. 4 boiler and turbo-generator at Coolkeeragh. —See 2 Nov. issue.

**18 Dec.—Southampton C.B.C.** Electrical installation in College of Technology.—Advertised 2 Nov. issue.

**18 Dec.—Tonbridge U.D.C.** Supply and erection of sewage pumps: two 300 g.p.m. at 28 ft head; two of 450 g.p.m. and two of 900 g.p.m. at 42 ft heads.—See 16 Nov. issue.

**18 Dec.—West Riding C.C.** Rewiring of 2 to 8 Bond Terr, Wakefield. Divisional Architect, Bishopgarth, Westfield Rd, Wakefield.

**10 Jan.—Southport C.B.C.** Sub-contract 3. Electrical installation in Canning Rd Bus Depot extension. Borough Architect and Town Planning Officer's Dept., 99-105 Lord St. Deposit £2 2s. Documents to be issued on 2 Dec.

**5 June.—Campbeltown.** N.A.T.O. Infrastructure contract, value £50,000, including flameproof gear for P.O.L. storage depot for power distribution and control, exterior lighting, installations including lighting in buildings, pipeline heating, earthing and bonding. Applications to Director General, Navy Wks, Admiralty, Chamberlain Way, Pinner, Middx, by 2 Feb., reference NWD/INFRA/19 (Electrical Installation).—Advertised in this issue.

**No date stated—Ross and Cromarty C.C.** (b) Electrical work in Arthurville Hse, Tain. —See 16 Nov. issue.

**No date stated—Western Counties Hospitals.** Applications invited for inclusion in select list for electrical work.—See 16 Nov. issue.

## Your Queries Answered

*Readers are invited to make use of our free enquiry department which possesses wide resources, including an index of trade information with over 100,000 entries*

### *A Selection from the 112 queries answered this week*

**"Junction" irons**—makers of? A.P.C.—G. P. Chamberlain and Co. Ltd., Junction Wks, Carmichael Rd, S.E.25.

**"Kienzle" battery operated clocks**—agents for? G.R.M.—B. H. Ries Ltd., 19 Hatton Gdn, E.C.1.

**"Gayheat" infra-red heaters**—makers of? F.L.C.—Besper Electrics Ltd., 113 Nathan Way, Woolwich, S.E.18.

**"Riber" washing machines**—agents for? T.E.—Ecconu Ltd., 121 Edgware Rd, W.2.

**"Sullivan" fires**—makers of? L.E.B.—H. W. Sullivan Ltd., 72 Leo St, Peckham, S.E.15.

**"Klipoon" connectors**—makers of? R.E.—Klippon Electricals Ltd., Power Station Rd, Sheerness, Kent.

**Door-opening systems for garages**—makers of? L.O.—Bolton Gate Co. Ltd., Waterloo Rd, Bolton, Lancs; Andrew Wise Ltd., 25 London Rd, Southend-on-Sea, Essex; Westland Engineers Ltd., Hendford, Yeovil, Somerset.

**"Kalomix" food mixers**—address for? E.T.E.—C.D.P. Ltd., No. 1 Pyper's Hatch, Harlow, Essex.

**"Everest Karsomatic" washing machines**—address for spares? E.E.B.—Elgee Refrigeration, 180 Brompton Rd, S.W.3.

# . . . and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon Hse, Theobalds Rd, W.C.1, quoting reference.*

**4 Dec.—Australia.** 120 15 kVAr and 12 180 kVAr 415 V capacitors complete with contactors. Secretary, S.E.C. of Victoria, 22-32 William St, Melbourne. B.o.T. (ESB/34620/61).*

**4 Dec.—Burma.** 1·5 V dry cells; 12 V batteries; and three 5 h.p. motors. Director-General, Union of Burma Purchase Board, St. John's Rd, Rangoon. B.o.T. (ESB/35422/4 and 5/61).*

**5 Dec.—Singapore.** 660 tubular steel poles and 200 polyphase house service pattern meters. City Council, Electricity Dept. B.o.T. (ESB/35497 and 8/61).*

**6 Dec.—Portuguese West Africa.** Three 15/0·4 kV transformer stations, together with uprating of two further stations and cabling. Luanda Light and Water Board, Rue D. Miguel de Melo, Luanda. B.o.T. (ESB/34999/61).*

**7 Dec.—India.** 100 transformers for 33, 11 and 0·416 kV, 50 and 100 kVA. Specification PS/E-2/67/TN-277 from Purchase Officer III, Rajasthan S.E.B., Power Hse, Jaipur. fee Rs 25, by P.O. or M.O., sent direct to Executive Engineer (Procurement II).

**10 Dec.—Kuwait.** Cables, v.i.r. and p.v.c. (ten items). President, Dept. of Electricity, Water and Gas. B.o.T. (ESB/35475/61).*

**11 Dec.—Australia.** 415 V 10 kVA stand-by diesel alternator. Secretary, S.E.C. of Victoria, 22-32 William St, Melbourne. B.o.T. (ESB/34619/61).*

**12 Dec.—Singapore.** Cables (13 items) totalling 100,000 yd. City Council, Electricity Dept. B.o.T. (ESB/35499 and 500/61).*

**13 Dec.—Kuwait.** (1) 25,000 yd four-core 0·0225 sq in.; (2) 110,000 yd two-core 0·0225 sq in.; (3) 110,000 yd two-core 0·007 sq in. p.v.c. insulated and sheathed d.s.w.a. cable and c.i. joint boxes. Dept. of Electricity, Water and Gas. B.o.T. (ESB/35472/61).*

**15 Dec.—South Vietnam.** Three central masters and 28 staff stations intercom. systems. Central Purchasing Authority, P.O. Box H-5, Saigon. B.o.T. (ESB/35199/61).*

**17 Dec.—Kuwait.** 200 eight U.S. gallon drinking water coolers. Dept. of Electricity, Water and Gas. B.o.T. (ESB/35477/61).*

**17 Dec.—New Zealand.** Air-depolarised primary cells, etc. Director-General (Stores Division), G.P.O., Wellington. B.o.T. (ESB/35438/61).*

**18 Dec.—India.** 40 flameproof 3·3 kV oil-immersed c.b's. General Manager, Singareni Collieries Co. Ltd., Kothagudium Collieries P.O., Bhadrachellam Rd Station, Central Railway, Deccan. B.o.T. (ESB/34666/61).*

**20 Dec.—India.** 200 flameproof 400/440 V c.b's. General Manager, Singareni Collieries Co. Ltd., Kothagudium Collieries P.O., Bhadrachellam Rd Station, Central Raliway, Deccan. B.o.T. (ESB/34667/61).*

**21 Dec.—Trinidad.** Cable three-core 0·6 sq in. to 0·2 sq in. (three items); transformers 32/12 kV 3 and 6 MVA and 66/12 kV 6 MVA and one c.b. Purchasing Officer, Trinidad and Tobago E.C., G.P.O. Box 121, Port of Spain. B.o.T. (ESB/34605/61).*

**27 Dec.—Sudan.** Sound equipment including amplifier, microphones and loudspeakers for Sudan Hotel. Office of Controller of Stores, Sudan Railways, Atbara. B.o.T. (ESB/35738/61).*

**28 Dec.—India.** Tender S/54/DLF. Intercom. system for Chandrapura Thermal Station. Documents, fee 14s 4d, from India Store Dept. (C.D.N. Branch), Government Bldgs, Bromyard Ave, W.3.

**4 Jan.—India.** Tender S/62/DLF. 415 V motor control centres and motor lock-out switches for Chandrapura Thermal Station. Documents, fee 14s 4d, from India Store Dept., Government Bldgs, Bromyard Ave, W.3. Viewing reference S.3519/61/NSC/ENG.2.

**9 Jan.—India.** Tender S/65/DLF. Ash-handling plant for Chandrapura. Documents, fee £1 1s 5d, from India Store Dept., Government Bldgs, Bromyard Ave, W.3. Viewing reference S.3523/61/NSC/ENG.2.

**11 Jan.—India.** Tender S/66/DLF. Coal transportation and handling plant with auxiliaries for Chandrapura. Documents, fee £1 1s 5d, from India Store Dept., Government Bldgs, Bromyard Ave, W.3. Viewing reference S.3522/61/NSC/ENG.2.

**19 Jan.—New Zealand.** 6·6 kV switchgear for Mt. Wellington substation. Chairman, Auckland E.P.B., Queen St, Auckland. B.o.T. (ESB/34994/61).*

**31 Jan.—Peru.** 9 km oil-filled 220 kV cable for use in Huinco Project for Lima Light and Power Co. Documents, fee ten U.S. dollars, from Motor-Colombus Electrical Management Co. Ltd., Parkstrasse 27, Baden, Switzerland.

# CONTRACTS PLACED

**Bolton B.C.** Provision of two lifts at School Hill, Express Lift Co. Ltd.. Recommended.

**Cardiff C.C.** Street lighting erection, contract 9, Machinery Installations (S. Wales) Ltd., £2,355. Lift installation in Llanishen Home for Aged Persons, Electro Lifts Ltd., £1,920. Recommended.

**C.E.G.B.** Contracts placed during October amounting to £6,800,000 include: Blyth "B" power station: dust-handling plant, Babcock and Wilcox Ltd.; two 400 MVA 275 kV generator transformers Nos. 7 and 8, Ferranti Ltd.; 11 kV switchgear and accessories, A. Reyrolle and Co. Ltd.—Thorpe Marsh power station: main and auxiliary cables and accessories, Pirelli-General Cable Works Ltd.; No. 2 turbo-alternator block, Mitchell Construction Co. Ltd.—West Burton power station: drain pump in Burton Round, Laneham Internal Drainage Board; ash- and dust-handling plant, Babcock and Wilcox Ltd.; two 110-ton overhead electric travelling cranes for turbine house, Cowans Sheldon and Co. Ltd.—Drakelow "C" power station: control panels, desks and equipment, George Kent Ltd.—Droylsden substation: two 132/33 kV 90 MVA transformers and auxiliaries, Crompton Parkinson Ltd.—Wavertree and Lister Drive substations: three 132/33 kV 60 MVA transformers and auxiliaries, Crompton Parkinson Ltd.—Bury St. Edmunds substation: two 132/33 kV 60 MVA transformers, C. A. Parsons and Co. Ltd.—Ashford and Ruckinge substations: 132 kV switchgear, English Electric Co. Ltd.—East Ham substation: 66 kV and 11 kV cabling, Pirelli-General Cable Works Ltd.—Sydenham substation: two 45 MVA 132/33 kV transformers, Hackbridge and Hewittic Electric Co. Ltd.—Betteshanger substation: two 60 MVA 132/33 kV transformers, Yorkshire Electric Co.—Wimbledon-Wandsworth: 132 kV underground cabling, Pirelli-General Cable Works Ltd.—Beddington-Purley: 132 kV underground cabling, Enfield Standard Power Cables Ltd.

**Coventry C.C.** Floodlighting of Butts Stadium, Revo Electric Co., £996. Recommended.

**Esher U.D.C.** Contract 325. Street lighting installation along A.3, Eleco Ltd., £2,410.

**Glasgow C.C.** Installation of six lifts in Phase I (Southern Section), Ladywell Hsg Development Scheme, A. P. Steven Ltd., £34,204. Recommended.

**Greenwich B.C.** Conversion of Kidbrooke Pk Rd and Strathedon Rd lighting to 200 W sodium, Eleco Ltd.. Recommended.

**Hastings C.B.C.** Rewiring work in Education Dept., S. F. Chapman and Son, £1,685. Recommended.

**Middlesbrough B.C.** Supply of: 700 80 W mercury street lanterns, Revo Electric Co., £6 15s 9d each; 700 aluminium columns, Metal Developments Ltd., £11 10s each.

**N.W. Metropolitan Hospitals.** Electrical work in stage one of Luton and Dunstable Hospital, James Kilpatrick and Son Ltd., £71,066. Recommended.

**Rayleigh U.D.C.** Supply and erection of 68 Gp "B" columns/lanterns/gear along Daws Heath Rd, Church Rd, Leslie Rd, White Hse Chase and Link Rd, Abacus Municipal Ltd.

**Richmond (Yorks) B.C.** Rewiring of 21 Bridge Terr houses, D. M. Mclean.

**Spadeadam, Cumberland.** Provision of street lighting on rocket establishment for Ministry of Wks, Aberfren Cable and Construction Co.

**Stoke-on-Trent C.C.** Electrical installations in: 113 dwellings on Longton estate, Barker and Co., £3,206; 96 on Sneyd Green estate, E. Holloway Ltd., £3,012. Recommended.

**Stretford B.C.** Electrical installations in 22 Nansen Close houses, £1,703. Recommended.

# TRADE NOTES

**Change of Address.** The Leeds branch of Santon Ltd. has moved to larger premises at 123 Water La, Leeds 11. Telephone No. 28762/35671. The Appliance Design Centre of G.E.C. (Domestic Equipment Ltd.) has moved to Langley Hse, Hanger La, Ealing, W.5. Telephone Perivale 6691.

**New Branch.** Telcon Plastics Ltd. are reopening on 1 Dec. the branch at 16-17 Hills Ter, Cardiff, previously operated by the Telegraph Construction and Maintenance Co.

**Servicing.** Production of the present model of the Colston dishwasher has been discontinued, to be replaced by new models, but spares and the service organisation are still available from Charles Colston Ltd., Wellington Rd, High Wycombe.

**Agency.** B. and R. Relays Ltd., Temple Fields, Harlow, have been appointed sole selling agents for Gt. Britain for dry reed switches made by the Gordos Corporation of America.

**Distribution.** British Radio Corporation Ltd. announce that as a result of an extension to the agreement between T.E.I. and E.M.I. they become sole distributors of record players and tape recorders bearing the "His Master's Voice" mark, for home sales.

**BEAMA Contract Price Adjustment Formulae.** *For Electrical Machinery and Equipment.* For purposes of calculating variations in: (*a*) "Rates of Pay"—the rate of pay for adult male labour at 17 Nov., 1961, shall be deemed to be 213s 6d; (*b*) "Cost of Material"—the index figure for materials used in the Electrical Machinery industry at 17 Nov., 1961, is 118·7* (184·1*).

*For turbo-generating and Allied Plant.* For purposes of calculating variations in: (*a*) "Rates of Pay"—the rate of pay for adult male labour as at 17 Nov., 1961, shall be deemed to be 213s 6d; (*b*) "Cost of Materials"—the index figure for materials used in the Mechanical Engineering Industry at 17 Nov., 1961, is 128·4* 192·9*). "Blast Furnace and Iron and Steel Melting and Rolling (1948 S.I.C. ref. 40/41)" 191·5. Other Steel Goods excluding tubes (1958 S.I.C. ref. 311/2), 130·5.* The price of brass condenser tubes ¾ in. o/d 18 s.w.g. on 17 Nov., 1961, is 4s 1½d per lb. *Provisional figure.

The figures in parentheses shown above relate to earliest list of wholesale price index numbers in which the year 1949 is taken as the base 100. For the other figures 1954=100.

**Test facilities.** Experimental facilities at the Bolton lift works of Wm. Wadsworth and Sons Ltd. are being considerably increased by the construction of a second lift testing tower, 123 ft high, with a maximum equivalent dead load at top of 20 tons.

**Move completed.** The final stage of the move-in of Solartron Laboratory Instruments at the new factory at Cox La, Chessington, has now been completed.

# BUSINESS PROSPECTS

**Alnwick.** U.D.C. propose 100 houses, Fisher La. Surveyor.

**Ashton-in-Makerfield.** U.D.C. propose £9,350 street lighting programme, 1961-62.

**Birmingham.** Factory, New Summer St, Aston, proposed for Wood and Perkins Ltd., 42 Wright St, Birmingham 10.

**Blackburn C.B.C.** Tender: 126 three-storey flats, Montague St. Engineer.

**Bolton.** Planned: laboratory, Beehive Foundry, Bark St, for Ryder Bros., of that address.

**Boston.** New store, Strait Market, proposed by Montague Burton Ltd., Hudson Rd, Leeds 9.

**Brighton.** Proposed factory at Falmer Rd, for Jaycee Furniture Ltd., Brighton, to cost £100,000. Architects: Morgan and Carn, 12 Grand Ave, Hove.

**Burnham-on-Sea.** Somerset C.C. propose home for 50 people, Steart Dr, to cost £73,365.

**Burton-on-Trent.** Proposed: Robert Sutton R.C. secondary school, Bluehouse La. Architects: Sandy and Norris, 134 Newport Rd, Stafford.

**Cardiff.** C.C. propose rewiring and improvements to electrical installation, Law Courts; cost: £5,000.

**Chesterfield.** Industrial development, Turnoake La, proposed by Robert McGregor and Sons Ltd., Walkden, Manchester.

**Corby D.C.** Proposed: 189 dwellings, North Lawn Housing. General Manager, Corby D.C., Spencer Hse.

**Dagenham.** Factory extensions proposed for Shaw of London (Furniture) Ltd., 35 Central Parade, Hoe St, Walthamstow.

**Darlington.** B.C. propose 28 houses, Newton La estate. Borough Architect.

**Derwent R.D.C.** Tender: pumping station, Naburn Sewage Works; Fairbank and Son, 29 St. Mary's, Bootham, York.

**Durham.** C.C. award £153,823 contract for modern school, Chilton, to Middleton and Co., Queen Alexander Bridge Approach, Sunderland.

**Eccles.** B.C. propose 312 dwellings on nine sites; Borough Engineer.

**Enfield.** B.C. propose 50 Group "A" columns for Cecil Rd, Myddleton Ave; also propose 75 aged persons' dwellings, Jasper Rd; Engineer.

**Esher.** Proposed: by Hodgsons Kingston Brewery Ltd., Kingston, and Thames Electric Co., Ltd., Kingston, a warehouse, offices and showroom, High St. Offices to cost £100,000 planned, Littleworth Rd, for Badix Properties Ltd. Quantity Surveyor: D. A. Parker, 13 The Ave, Hitchin, Herts.

**Felling.** Proposed: grammar technical school, and College of Further Education, Lingey La. Co. Architect, South St, Durham.

**Gateshead.** B.T.C. propose £1 million freight terminal.

**Glasgow.** Marten Development Co., 62 West Nile St, propose nine-storey hotel, Bath and West Nile streets.

**Glossop.** Single-storey factory, rear of Brookfield recreation ground, planned for Mamil Plastics, Stalybridge, Cheshire.

**Gosforth.** Wm. Leech Ltd., St James St, Newcastle, proposes commercial and residential development, Fawdon Red Hse Fm estate.

**Greenock.** Proposed by Murrayfield Real Estate Co. Ltd., 62 St. James's St, S.W.1, re-development of town centre.

**Hartlepool** N.E. Housing Association, propose 101 houses, King Oswy Drive. Architects, P. L. Browne, Son and Harding, Pearl Bldgs, Northumberland St, Newcastle.

**Heywood.** Heywood Precision Engineering Co. Ltd., Rock St, propose engineering works, Mount St.

**Horbury.** Office block, Benton Hill, proposed for Richard Sutcliffe Ltd. Architects: Enthoven and Moek, 5 Raymond Bldgs, Grays Inn, W.C.1.

**Houghton-le-Spring.** Rebuilding of premises, Durham Rd, proposed for The Pearl Assurance Co. Ltd. Plans by W. S. H. Julian, 252 High Holborn, W.C.1.

**Hull.** Humber Conservancy Board, Whitefriargate to reconstruct Sammys Point comprising offices, workshops, stores and canteen.

**Kirkcaldy.** B.C. propose 85 dwellings, Nicol St; Burgh Engineer, Town Hse.

**Leamington Spa.** Proposed: factory, Queensway trading estate, for D.H.B. Tools Ltd., Everseal Hse, Queensway; telephone engineering workshop, Althorpe St, trading estate, for Ministry of Works, Queens Rd, Coventry.

**Leeds.** Multi-storey block of shops, offices and basement cinema, City Sq, proposed by Cussins (Contractors) Ltd., The Drive, Gosforth, Newcastle. C.C. appoint Leake and Wilson, 2a Drummond Rd, Leeds 16, electrical consultants for proposed remand home, Whinnow and Swinnow C.P. School.

**London.** The Bernard Sunley Investment Trust (Management) Ltd., 25 Berkeley Sq, W.1, plan to erect a commercial building with offices on an island site bounded by Newington Causeway, Southwark Bridge Rd and Lancaster St, S.E.1. Cost: £250,000. Shops, showrooms and offices, Euston Rd, proposed to plans by R. Seifert and Ptnrs, architects, 34 Red Lion Sq, W.C.1. St. Georges Cathedral R.C. School, Lambeth Rd, S.E.1, to be rebuilt. Architects: F. G. Broadbent and Ptnrs, 13 Manchester Sq, W.1.

**Luton.** Proposed: Seven-storey factory with offices, canteen, etc., Guildford St, for Ellis and Goldstein Ltd., 40 Guildford St. Planned: switch house for new factory, Chaul End Rd and Leicester Rd, for Alcock (Peroxide) Ltd., Leicester Rd. Proposed eight-storey block of shops/offices, King St, and George St. West, for E. and E. C. Crowley.

**Newburn.** Factory additions proposed by K. and L. Steelfounders, Letchworth. Contractors, Tarmac Civil Engineering Ltd., Bowesfield La, Stockton.

**Newcastle.** Proposed by Percy Street Investments Ltd. £250,000 scheme for eight-storey block of offices and shops, junction of Gallowgate/Percy St. Architects: L. J. Couves and Ptnrs, Grainger Chmbrs, Hood St.

**North Riding.** C.C. award £111,219 contract for stage three of Cleveland Technical College to C. Tennet Ltd., Church Rd, Stockton; and contract for £84,141 to Shepherd and Son, Blue Bridge La, for proposed Geo Pindar Modern School.

**Norwich.** C.C. propose installation of improved lighting costing total of £11,000 in several areas.

**Nottingham.** A Hall of Residence, Beeston La, planned for University of Nottingham. J. Fletcher Watson, 3 Old Barrack Yd, Knightsbridge, S.W.1; Architect.

**Nuneaton.** B.C. propose installation of sodium lights on 20 ft columns at Whittleford Rd and Bucks Hill.

**Oxford.** Regional Hospital Board placed contract for extensions, Dellwood Maternity Hospital with McCarthy E. Fitt Ltd., Reading, at £64,279.

**Peterborough.** C. W. Shelton Ltd., South St, Stanground, propose 71 houses, Thorpe Gdns. C.C. propose 74 houses, Bluebell estate. City Engineer.

**Petworth.** Proposed: factory, Wisborough Green, for Carter Bros. (Billinghurst) Ltd., Wisborough Green, Billinghurst.

**Plymouth.** Extensions proposed for Johnson and Baxter Ltd., Wedgewood Village, Architects: H. J. Hammick and Son, Kintebury Hse, St. Andrews Cross. Proposed: bowling centre at Mayflower St. Architects: Edward Narracott and Ptnr, 36 Looe St.

**Reading.** Proposed: six factory buildings, Elgar Rd, for Nairn Trust Ltd.; factories at their estate, Whitley Kiln, for Westminster Construction Co. Ltd., 36 Westminster Palace Gdns, S.W.1. Governors of Leighton Park School propose extensions and new buildings to cost £200,000. Proposed: ten-storey office building, Reading Bridge, for Marcus Investments Ltd., Portsea Hall, Connaught Sq, W.2. Cranleigh Group, plan redevelopment of Palace Theatre site, Cheapside. Architects: Chaplin and Burgoine, 4 Cathedral Close, Norwich.

**Rotherham.** B.C. appoint A. E. Mohring and Sons, electrical consultants for proposed extensions to South Grove Secondary School.

**St. Andrews.** Dansken and Purdie, 11 Randolph Pl, Edinburgh 2, quantity surveyors for St. Salvators College, new physics and maths building for University.

**St. Asaph.** Proposed: factory, Glascoed Rd, erected by Industrial Estates Management Corp. for Wales, Pontypridd. Will be occupied by Ega Electric Ltd., Basinghall St, E.C.2.

**St. Ives.** R.D.C. propose modernisation of 116 pre-war houses, Surveyor, St. Ives, Hunts.

**Scarborough.** B.C. award £238,736 contract for additions to Town Hall, to Monk and Co. Ltd., Albert Rd, Middlesbrough.

**Sedgefield.** Newcastle Regional Hospital Board, Benfield Rd, Newcastle, propose nurses' teaching centre, Winterton Hospital. Board Architect.

**Shotley Bridge.** Newcastle Regional Hospital Board, Benfield Rd, Newcastle, propose new casualty, out-patients and X-ray depts., Shotley Bridge General Hospital. Consulting engineers: R. W. Gregory and Ptnrs, Pilgrim Hse, Pilgrim St, Newcastle.

**South Shields.** B.C. propose 107 houses, Reading Rd, Brinkburn estate. Engineer. N.E. Housing Association propose 98 traditional houses, Newton Hall estate. Architects, Richard Turley and Asscts, 46 Jesmond Rd, Newcastle.

**Stafford.** Canteen to cost £80,000, proposed for Universal Grinding Wheel Co. Ltd., Doxey Rd.

**Stockton.** Lane Fox and Co. Ltd., Norton Rd, propose residential development of eight acres, South Rd area.

**Stoke-on-Trent.** Cinema and bowling centre in £400,000 four-storey building, with shops on street level and offices above, planned, Hanley, by Assoc British Cinemas Ltd., 30 Golden Sq, W.1.

**Sunderland.** Proposed: Bishop Harland C. of E. school, Hylton Red Hse estate. Architects: R. Middleton and Ptnrs., 111 Albert Rd, Middlesbrough.

**Surbiton.** A 22-storey building for shops, a supermarket and offices adjoining Kingston By-pass at Tolworth is planned. Architects: R. Seifert and Ptnrs, 34 Red Lion Sq, W.C.1. B.C. propose second stage of street lighting scheme to cost £30,000.

**Torquay.** A new bowling centre to cost £100,000, Higher Union St, proposed for D. Maxwell. Architects: Edward Narracott and Ptnr, 48 Torwood St.

**Wallasey.** Proposed: shopping precinct to cost about £3 million, Liscard. Developers, Metrovincial Properties Ltd., 15a Hay Hill, W.1.

**Wandsworth.** B.C. propose 103 dwellings, 21 stores, New Park Rd site; cost: £321,000.

**Watford.** Cold store/offices, Radlett, proposed for Birds Eye Foods Ltd., Hesketh Hse, Portman Sq, W.1.

**Wednesbury.** New factory proposed: Nesbit-Evans and Co. Ltd., Wednesbury. Cost: £90,000. Contractors: Wilson Lovatt and Sons Ltd., Clarence St, Wolverhampton.

**Welwyn.** Proposed by N.W. Metropolitan Regional Hospital Board, resident medical officers' and domestic hostels, Welwyn-Hatfield New Hospital, Welwyn Garden City. Regional Architect, 40 Eastbourne Terr, W.2. Estimated cost: £135,000.

**West Auckland.** Proposed for British Belting and Asbestos Ltd., 253 Newport Rd, Middlesbrough, development of about 2½ acres Darlington Rd, as industrial site.

**Whitley Bay.** Proposed: £60,000 Y.M.C.A., club and hostel, Marine Ave and Park View. Architects: P. J. Steinlet and Son, 40 Queen Sq, Newcastle.

**Wigston.** U.D.C. propose £300,000 sewage works extension scheme, including electrical work. Surveyor.

# GAZETTE ANNOUNCEMENTS

## COMPANIES ACTS

**Woodgrange Electrics Ltd.** Creditors to send details to liquidator: L. C. Curtis, 13 Wimpole St, W.1, by 28 Nov.

**Don Kenyon Electrical (Nottingham) Ltd.** Creditors to send details to liquidator: R. C. Ravensdale, 42 Friar Gate, Derby, by 28 Nov.

**J. W. H. Bethel Ltd.** Mr R. A. Hawken, Bank Chmbrs, 1 John St, Bedford Row, W.C.1, appointed liquidator at extraordinary general meeting on 2 Nov. for the purpose of voluntarily winding-up.

**Exelec Ltd.** Mr J. W. Baggett, 90a Highgate High St, N.6, appointed liquidator at extraordinary general meeting on 7 Nov. for the purpose of voluntarily winding-up. Creditors to send details by 24 Nov.

**Matthews and Wright Ltd.** Mr R. W. Hellyer, Brotherton Hse, Westgate, Leeds 1, appointed liquidator at extraordinary general meeting on 7 Nov. for the purpose of winding-up.

**Domestic Appliances (Northern) Ltd.** Final general meeting to be held at 46 Park Sq, Leeds 1, on 20 Dec., at 2.30 p.m., for the purpose of receiving an account of the winding-up proceedings.

**Leslies Electrical Ltd.** General meeting to be held at 112 Crescent Rd, Reading, on 15 Dec., at 2.30 p.m., for the purpose of receiving an account of the winding-up proceedings.

**Wm. B. Abel and Son Ltd.** Last day for receiving proofs for intended dividend: 25 Nov., by liquidator: G. C. Ehlers, 28 Baldwin St, Bristol 1.

**Patomic Ltd.** Mr J. B. Howse, 15 Cromwell Rd, S.W.7, appointed liquidator at extraordinary general meeting on 28 Oct.

**Air Conditioning and Eng. Ltd.** General meeting to be held at 26-28 Hallam St, Portland Pl, W.1, on 18 Dec., at 10 a.m., for the purpose of receiving an account of the winding-up proceedings.

**Lowelectrix Ltd.** First meetings of creditors and contributories to be held at Official Receiver's Office, Somerset Hse, 37 Temple St, Birmingham 2, on 28 Nov., at 2.30 and 3 p.m., respectively.

**Reelek Appliances Ltd.** First meetings of creditors and contributories to be held at Room 401, Inveresk Hse, 346 Strand, W.C.2, on 29 Nov., at 11.30 a.m. and 12 noon, respectively.

*Voluntary Liquidation*

**Walter Instruments Ltd.,** Garth Rd, Morden, Surrey, electrical and electronic equipment manufacturers.

The statement of affairs as at 30 Sept. disclosed liabilities amounting to £256,292, with £109,480 due to cash creditors, £97,800 to sundry creditors, £12,012 to Walter (Sales) Ltd. (in liquidation); and £37,000 in respect of contingent liabilities. Assets were estimated to produce £120,446.

Trading accounts for 1958 and 1959 disclosed small profits, but for the period 1 Jan., 1960, to 15 Feb., 1961, there was a loss of £150,000 on turnover which was reduced to £613,030.

Mr C. E. M. Emmerson, 28 King St, E.C.2 and Mr H. W. Pitt, 100 Park St, W.1, were appointed joint liquidators with a committee of inspection.

*Partnership Dissolved*

**Salford.** Partnership between L. Bloom and H. Evans, appliance wholesalers, carrying on business at 98-100 Chapel St, Salford 3, was dissolved as from 31 Oct.

## BANKRUPTCY ACTS

*Receiving Orders*

**Nottingham.** D. and M. Martin, radio and electrical engineers, carrying on business at 13 Rose Cottages, Burton Joyce, and formerly at Meadow La, Burton Joyce. Receiving order dated 3 Nov.

**Northampton.** J. B. English, electrical engineer, carrying on business at 1 Harrogate Court, Corby. Receiving order dated 13 Nov.

*Public Examinations*

**Scarborough.** C. Parker, refrigeration and electrical sales and service proprietor, formerly carrying on business at 4 Newlands Park Rd. Public examination: 11.45 a.m., 16 Jan., at Court Hse, Castle Rd, Scarborough.

**Carlisle.** G. H. Mattinson, builder and electrical contractor, carrying on business at The Forge, Waver Bridge, Wigton. Public examination: 10.30 a.m., 11 Dec., at County Court Offices, 39 Lowther St, Carlisle.

**Leicester.** S. C. Doubleday and K. W. Palmer, radio and television dealers and electrical contractors, formerly carrying on business as Doubleday and Partner at Brook St, Braunston. Public examination: 10.30 a.m., 5 Jan., at The Castle, Leicester.

**Liverpool.** I. M. Swallow, electrical contractor, formerly carrying on business as Electrical Repairs and Trading Co. at 19 Blyth Hey, Litherland. Public examination: 10 a.m., 9 Jan., at Court Hse, India Bldgs, Water St, Liverpool 2.

*Application for Discharge*

**Sunderland.** J. R. Short, electrical contractor, formerly carrying on business at 11 Rutland Ave, Bishop Auckland. Application for discharge to be heard at Court Hse, John St, Sunderland, at 10 a.m., on 13 Dec.

*Release of Trustee*

**Norwich.** G. R. Overton, radio and electrical engineer, carrying on business at Rockland All Saints, Attleborough. Trustee: C. A. Taylor, Exchange St, Norwich, released as from 3 Nov.

*Intended Dividends*

**Newcastle upon Tyne.** W. Bell, radio and TV dealer and electrical contractor, formerly carrying on business as Heaton Electronics at 61 Headlam St, Byker. Last day for receiving proofs for intended dividend: 28 Nov., by trustee: W. Armstrong, Clarendon Hse, Clayton St West, Newcastle upon Tyne 1.

**Rochdale.** J. Hilbert, radio and electrical engineer, of 17 Manchester Rd, Haslingden. Last day for receiving proofs for intended dividend: 1 Dec., by trustee: J. Tye, 20 Byrom St, Manchester 3.

# NEW COMPANIES

*Extracted from the Register issued by Jordan and Sons Ltd., 116 Chancery La, W.C.2.*

**B. R. Ainsworth and Co. Ltd.,** 16 Tavistock Gdns, Ilford. To take over the business of manufacturers of insulating jackets for domestic hot water cylinders and tanks carried on at Ilford by Beatrice R. and J. S. Ainsworth, etc. Nom. cap.: £200. Permanent dirs.: Beatrice R. Ainsworth and Leslie S. Ainsworth.

**Allied Electrical and Plumbing Services Ltd.,** 12 Varley Parade, Edgware Rd, The Hyde, N.W.9. Nom. cap.: £1,000. Dirs.: to be appointed by subs. Subs.: Matthew Gibb and Miss Charlotte R. Moore.

**Aron Meters Ltd.** Engineers, manufacturers of and dealers in meters for the measurement of the consumption of electricity, etc. Nom. cap.: £100. Dirs.: to be appointed by subs. Subs.: Christopher K. Walford and A. L. Leddiman, 9-12 Cheapside, E.C.2.

*The above company is the result of the sale of Aron Electricity Meter Ltd. meter business to Ferranti Ltd. as reported 16 Nov., page 743.*

**Barwall (Electrical) Ltd.,** 13 Well Court, Bow La, E.C.4. Nom. cap.: £100. Dirs.: to be appointed by subs. Subs.: Laurence R. Battell and William J. Wildman.

**D. Bastie Ltd.,** 35 Canterbury Rd, Harrow, Middx. Electrical engineers and contractors, etc. Nom. cap.: £100. Dir.: Douglas H. Bastie.

**A. and M. Berry Ltd.,** Provincial Bank Chambers, Tooting Broadway, S.W.17. Manufacturers of and dealers in vacuum cleaners, etc. Nom. cap.: £500. Dirs: Alfred W. Berry and Mary Berry.

**Bird and Johnson (Electrical Engineeers) Ltd.,** 10 Frayne Rd, Ashton, Bristol 3. Nom. cap.: £100. Dirs.: Kenneth W. G. Bird and Richard Johnson.

**Born Heaters Ltd.,** 3 London Wall Buildings, E.C.2. Manufacturers of and dealers in plant whether for, or in connnection with, process heating, etc. Nom. cap.: £5,000. Dirs.: not named. Subs.: H. S. K. Peppiatt and A. J. G. Hamilton.

**Delve and Nankervis Ltd.,** Porthmeor Rd, St. Ives, Cornwall. To take over business of electrical contractors carried on at Bedford Rd, St. Ives, by Delve and Nankervis, etc. Nom. cap.: £2,000. Dirs.: James T. Nankervis and Albert J. C. L. Delve.

**R. F. Dill Ltd.,** 182 Greenhill Rd, Leeds 13. Electrical goods manufacturers and dealers, etc. Nom. cap.: £100. Dirs.: Ronald F. Dill and Bernard Holroyd.

**Edwardes Bros. (Dulwich) Ltd.,** 6 Lordship La, S.E.22. Importers, exporters and manufacturers of and dealers in electrical and electronic engineering equipment, etc. Nom. cap.: £100. Dirs.: Lionel T. B. Edwardes, Wm. T. Beadle, Leon T. J. Edwardes and Mrs Alice E. F. Edwardes.

**Electrical Projects Co. Ltd.,** 49 Church St, Eccles, Lancs. Electrical engineers, etc. Nom. cap.: £100. Dirs.: Derek Nicholls and Mrs M. Nicholls.

**Elremco Sales Ltd.** Electrical and mechanical engineers, etc. Nom. cap.: £1,000. Dirs.: Jerzy K. Chuchla, Treetops, Tye Green Village, Harlow; John L. J. Stickley, 39 Great Leylands, Harlow; and Paul Gotley.

**Esner Electrical Co. Ltd.,** 124 Bury New Rd, Manchester 8. Nom. cap.: £100. Dir.: Cyril Esner.

**Hillvar Ltd.,** 13 Well Court, Bow La, E.C.4. Electrical, radio, television and general engineers, etc. Nom. cap.: £100. Dirs.: to be appointed by subs. Subs.: Laurence R. Battell and William J. Wildman.

**Packard Instrument Ltd.** Electronic, electrical and mechanical engineers, etc. Nom. cap.: £1,000. Dirs.: to be appointed by subs. Subs.: Peter R. Hylton, 29 Kensington Gate, W.8; and Wm. J. Sykes, 7-8 Norfolk St, W.C.2.

*This company has been formed to market the Packard Instrument Co. of La Grange, Illinois, range of transistorised nuclear research equipment which includes "Tri-carb" liquid scintillation spectrometers and flow monitors, together with chromatography instruments.*

**Priestley Control Panels Ltd.,** Junction Mill, Middleton Junction, Middleton, nr. Manchester. Nom. cap.: £500. Dirs.: Norman Priestley and Walter Gunningham.

**P. Sanders Ltd.,** 3 Bear Rd, Hanworth, Feltham, Middx. Electrical goods manufacturers and dealers, etc. Nom. cap.: £100. Dirs.: Peter R. Sanders, Philip Richards and Peter R. F. Caldecourt.

**Stirk and Mawson (Bradford) Ltd.,** Brimerco Hse, 9 Myrtle Pl, Bingley, Yorks. Electrical wholesale distributors, etc. Nom. cap.: £5,000. Dirs.: Henry K. Stirk and William A. Mawson.

**Technicon Instruments (Overseas) Ltd.** Engineers, scientific instrument manufacturers and dealers, etc. Nom. cap.: £100. Dirs.: to be appointed by subs. Subs.: Donald A. Marchant and John E. Emptage, 66 Queen St, E.C.

**Wholesale Industrial Electrical Equipment Ltd.** 61 Boldmere Rd, Sutton Coldfield. Nom. cap.: £100. Dirs.: Thomas F. McElhannan and Geofrey G. Thompson.

# MEETINGS TO NOTE

## THURSDAY, 23 NOV.

I.E.E. "The B.B.C. Television Centre and Its Technical Facilities," F. C. McLean, H. W. Baker and C. H. Colborn. Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (Educational Discussion Circle). Discussion: "The 57 Effects of an Electrical Current." Savoy Pl, W.C.2. 6 p.m.

I.E.E. (Western). Faraday Lecture: "Expanding Horizons in Communications," D. A. Barron. Sophia Gdns Pavilion, Cardiff. 6.45 p.m.

I.E.E. (N.E. Graduates and Students). "The Silicon Controlled Rectifier, a New Tool for the Power Engineer," R. Dunn. Sunderland Technical College. 6.30 p.m.

MINISTRY OF WORKS (St. Albans). "Combination of Natural and Artificial Lighting in Buildings," A. D. Charters. Hertfordshire College of Building, Hatfield Rd. 7.15 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Chester). "Transistors Applied to Modern Instrumentation," J. E. Fielden. Stanley Palace, Watergate St. 7 p.m.

A.S.E.E. (N. Ireland). "An Informal Talk," D. S. McIlhagger. Central Hall, Rosemary St, Belfast.

A.S.E.E. (Nottingham). "Plastics in the Electrical Industry," A. J. Moulam. People's College of Further Education, Castle Rd. 7.30 p.m.

A.S.E.E. (S. London). "The National Inspection Council for Electrical Installation Contracting," E. J. Sutton. Greyhound Hotel, Croydon. 8 p.m.

A.S.E.E. (Southampton). "Electric Water Heating." Polygon Hotel. 8 p.m.

## FRIDAY, 24 NOV.

I.E.E. (N. Staffs). Annual dance with Graduate and Student Section. Crown Hotel, Stone, Staffs. 8.30 p.m.

I.E.E. (S. Midlands). Discussion: "A Materials Course for Electrical Engineers." College of Technology, Gosta Green. 6.15 p.m.

I.E.S. (Cardiff). Dinner-dance. St. Mellons County Club.

I.E.S. (Glasgow Centre). Luncheon meeting. Grand Hotel, Charing Cross. 12.30 p.m.

A.S.E.E. (Coventry and District). "Industrial Motor Control Gear," B. Bardell. Conservative Rooms, 16 Queens Rd. 8 p.m.

A.S.E.E. (Halifax). Annual Dinner at Old Cock Hotel.

A.S.E.E. (Oxford and Districts). "Power Factor Correction," T. A. Williams. Technical College, Walton Rd, Aylesbury. 7.30 p.m.

A.S.E.E. (Stoke and Crewe). "Temperature Control," L. Clarke. Grand Hotel, Hanley. 7.30 p.m.

## MONDAY, 27 NOV.

I.E.E. (N.E.). "The Place of Formal Study in the Post-Graduate Training of an Electrical Engineer," N. N. Hancock and P. L. Taylor. Neville Hall, Westgate Rd, Newcastle upon Tyne. 6.15 p.m.

I.E.E. (N. Staffs). "Electric Traction," J. A. Broughall. Mechanics' Institute, Crewe. 7 p.m.

I.E.E. (Western Utilisation Group). "Silicone Electrical Insulation," J. H. Davis. South Wales Institute of Engineers, Cardiff. 6 p.m.

I.E.E. (S. Midlands Electronics and Measurement Group). Third Hunter Memorial Lecture: "The Application of Electronics to the Electricity Supply Industry," J. S. Forrest. James Watt Memorial Institute, Birmingham. 6 p.m.

R.S.A. Cantor Lecture: "Production for Export," R. M. Geddes. John Adam St, Adelphi, W.C.2. 6 p.m.

MINISTRY OF WORKS. "Essentials of Good Concreting," E. E. H. Bate. College of Further Education, High Wycombe. 7.15 p.m.

I.E.S. (Birmingham Centre). "Lighting of Large Office Buildings," J. H. D. Madin. Chamber of Commerce, 75 Harborne Rd, Edgbaston. 6.30 p.m.

INSTITUTION OF PLANT ENGINEERS (W. and E. Yorks). "Basic Electronics in Industry and Commerce." R. H. Garner. Houldsworth School of Applied Science, Leeds University. 7.30 p.m.

A.S.E.E. (N.W. London). "Modern Electric Lifts." Compass Hotel, Watford. 8.15 p.m.

## TUESDAY, 28 NOV.

I.E.E. (Measurement and Control). Section dinner. Café Royal. 7.30 p.m.

I.E.E. (E. Midlands). Third Hunter Memorial Lecture: "The Application of Electronics to the Electricity Supply Industry," J. S. Forrest. Nottingham University. 6.30 p.m.

I.E.E. (S.E. Scotland). Informal talk: "An Impression of Moscow," Prof M. G. Say. Carlton Hotel, North Bridge, Edinburgh. 7 p.m.

I.E.E. (Southern). "Brushless Variable-speed Induction Motors Using Phase-shift Control." Prof F. C. Williams, E. R. Laithwaite, K. F. Eastham and W. Farrer. Farnborough Technical College, Farnborough. 6.15 p.m.

I.E.E. (N.W. Supply Group). "General and Topological Features of Some Hydro and Thermal Schemes," J. R. Mortlock. Engineers' Club, Albert Sq, Manchester 2. 6.15 p.m.

I.E.E. (Irish). Dinner-dance. Gresham Hotel, Dublin.

SOCIETY OF INSTRUMENT TECHNOLOGY. "Automatic Plant Analysis by Electrochemical Methods." R. F. Rodger. Manson Hse, 26 Portland Pl, W.1. 6.30 p.m.

INSTITUTION OF CIVIL ENGINEERS. "The Development of Modern Dry Dock Equipment," J. Read. Gt George St, S.W.1. 5.30 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS "Data Acquisition Systems," K. L. Smith. Farnborough Technical College. 7 p.m.

INSTITUTION OF PLANT ENGINEERS (S. Wales). "Design for Maintenance," R. N. Dale. Electricity Showrooms, 62 Kingsway, Swansea. 7 p.m.

A.S.E.E. (Aldershot and Districts). "The National Inspection Council," T. Howell. Basingstoke Technical College. 7.30 p.m.

## WEDNESDAY, 29 NOV.

I.E.E. (Electronics and Communications). "Recent Developments in Semiconductor Devices and Their Application," E. Wolfendale. Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (E. Midlands). "The Kariba Dam Project—Electrical Installations," C. J. Dickinson. George Hotel, Kettering. 7.30 p.m.

I.E.E. (Rugby). "An Oscillating Synchronous Linear Machine," E. R. Laithwaite and R. S. Mamak; "The Application of Linear Induction Motors to Conveyors," E. R. Laithwaite, D. Tipping and D. E. Hesmondhalgh. Rugby College of Engineering Technology. 6.30 p.m.

I.E.E. (S.W. Scotland). "The Banana Tube Display System—A New Approach to the Display of Colour Television Pictures," P. Schagen. Institution of Engineers and Shipbuilders, 39 Elmbank Cres, Glasgow C.2. 6 p.m.

I.E.E. (Southern). "Technical and Economic Aspects of the Supply of Reactive Power in England and Wales," W. Casson and H. J. Sheppard. C.E.G.B. Office, High St, Portsmouth. 6.30 p.m.

I.E.E. (London Graduates and Students). "Some Aspects of the Control and Guidance of Guided Weapons," J. A. Miller. Medway College of Technology, Chatham. 7 p.m.

I.E.E. (Cambridge Electronics and Measurement Group). "Global Communication," R. J. Halsey. Cavendish Laboratory, Free School La, Cambridge. 8 p.m.

R.S.A. "Television in Schools," P. Adorian. John Adam St, Adelphi, London W.C.2. 6 p.m.

INSTITUTION OF MECHANICAL ENGINEERS (Hydraulic Plant and Machinery Group). Conference on "Oil Hydraulic Power Transmission and Control"; also on 30 Nov. 1 Birdcage Walk, Westminster, S.W.1. 6 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (S. Wales). "Differential Producers for Flow Measurement," H. E. Dall. Welsh College of Advanced Technology, Cathays Park, Cardiff. 6.45 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (Electro-Acoustics Group). "An Experimental Assessment of Loudspeaker Performance," R. Yorke. London School of Hygiene and Tropical Medicine, Keppel Street, London, W.C.1 6 p.m.

## THURSDAY, 30 NOV.

I.E.E. (Measurement and Control). Symposium on Nuclear Electronics. In conjunction with British Nuclear Energy Conference, until 1 Dec. Savoy Pl, W.C.2.

CHELMSFORD ENGINEERING SOCIETY. "The Prospects for Capital Goods in East/West Trade," J. B. Scott. Social Hall, Cromptons. 7.30 p.m.

INSTITUTION OF PRODUCTION ENGINEERS (N. Midlands). "Numerical Controlled Machine Tools," R. C. Brewer. Ruston Club, Lincoln. 7.30 p.m.

## FRIDAY, 1 DEC.

I.E.E. (Southern). "The Banana Tube Display System—A New Approach to the Display of Colour Television Pictures," P. Schagen. South Dorset Technical College, Weymouth. 6.30 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Fawley). "Applications of Transistors and Diodes," D. Osborne. Room 4a, Admin. Bldg, Esso Petroleum Co. Ltd. 5.45 p.m.

INSTITUTE OF PLASTICS (N. Western). "Plastics in Batteries," R. G. Robinson and R. L. Walker. Textile Institute, 10 Blackfriars St, Manchester 3. 6.45 p.m.

A.S.E.E. (Chester and District). Annual dinner-dance at Queens Hotel, City Rd. 8 p.m.

A.S.E.E. (Liverpool and District). "Mechanics of the Human Body," R. G. Harrison. Industrial Development Centre, M.A.N.W.E.B., Paradise St. 7.30 p.m.

## SATURDAY, 2 DEC.

A.S.E.E. (Oxford and Districts). Annual dinner at The Red Lion, Kidlington.

## MONDAY, 4 DEC.

I.E.E. (Electronics and Communications). Discussion: "Backward Waves in Waveguides." Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (Mersey and N. Wales). Lecture on "Simulation of Intelligence," D. M. MacKay. Royal Institution, Liverpool. 6.30 p.m.

I.E.E. (N.E. Measurement and Electronics Group). "Planning and Installation of the Sound Broadcasting Headquarters for the B.B.C.'s Overseas and European Services," F. Axon and O. H. Barron. College of Technology, Northumberland Rd, Newcastle upon Tyne. 6.15 p.m.

I.E.E. (Scottish Electronics and Measurement Group). "Precision Measurement," G. H. Rayner, and A. Felton. Royal College of Science and Technology, Glasgow. 6 p.m.

I.E.E. (S. Midlands). "The Banana Tube Display System—A New Approach to the Display of Colour Television Pictures," P. Schagen. (Combined meeting with Supply and Utilisation Group, Electronics and Measurement Group and Birmingham Centre of Institution of Post Office Electrical Engineers.) College of Technology, Birmingham. 6.30 p.m.

INSTITUTION OF MECHANICAL ENGINEERS (Applied Mechanics, Theory of Materials of Construction Group). Discussion: "Can Plastics Components Be Designed Rationally?" 1 Birdcage Walk, Westminster, S.W.1. 6 p.m.

E.P.E.A. (London Technical Group). "D.C. Transmission," T. E. Calverley. Tudor Room, Caxton Hall, S.W.1. 6.30 p.m.

R.S.A. Cantor Lecture: "Overseas Marketing," R. Falk. John Adam St, Adelphi, W.C.2. 6 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (S. Yorkshire). "Problems of Flow Measurement," H. E. Farrer. The University, Dept. of Fuel Technology, Mappin St, Sheffield. 7 p.m.

# TRADE MARKS

*This information is extracted from the Official Journal by permission of the Controller.*

**Andre Yardney** and **Silvercell** in designs. B804,991 and 2. Class 9. Batteries, cells, etc. Yardney International Corpn., 40-48 Leonard St, New York 13, N.Y., U.S.A.

**Atlas.** 808,822. Class 11. Installations for lighting. Thorn Electrical Industries Ltd., 105-109 Judd St, W.C.1.

**Audiomatic.** 816,423. Class 9. Apparatus for recording, amplifying and reproducing sound. Planned Equipment Ltd., Regent Hse, 235 Regent St, W.1.

**Batilla, Pelsola, Latamo, Pabula** and **Dabata.** 823,673/7/81/5 and 93. Class 10. Heated pads and blankets. **Pelsola.** 823,678. Class 11. Insulations for lighting, heating, etc. A.E.I. Gala Ltd., 33 Grosvenor Pl, S.W.1.

**ConStor.** 821,244. Class 11. Heating appliances, etc. Bastian and Allen Ltd., Ferndale Terr, Harrow, Middx.

**Frescon.** 824,714. Class 11. Installations for lighting, heating, etc. A.E.I.-Birlec Ltd., 33 Grosvenor Pl, S.W.1.

**Hellermann.** B820,460. Class 17. Plastics materials, for binding, insulating and identifying cables, etc. Hellermann Ltd., Gatwick Rd, Crawley, Sussex.

**M.K.** in design. 821,565. Class 9. Connections, switches, etc. M.K. Electric Ltd., Shrubbery Rd, N.9.

**Permalite.** 798,951. Class 11. Hand lamps. Meyer Mnfg. Co. Ltd., 55 Kowloon City Rd, To-kwa-wan, Kowloon, Hong Kong.

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Keepalite, the Chloride Company's automatic emergency lighting system, is now equipped exclusively with the new Chloride Planté cell which occupies only half the space previously needed by cells of the Planté type of equivalent capacity. Keepalite thus adds this important advantage to the many virtues that have made it the most trusted and widely used emergency lighting system in Great Britain. Despite its small size and light weight, the new cell is extremely robust and has all the great length of life associated with the Planté type of construction. As always, the advisory service of the Company's electrical engineers is at the call of electrical contractors and engineers who are interested in emergency lighting installation.

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5IV

# CLASSIFIED ADVERTISEMENTS

## TENDERS INVITED

### POTTERS BAR URBAN DISTRICT COUNCIL

**Electrical Re-wiring of 50 Council Houses, Cranborne Road.**

TENDERS are invited for the electrical re-wiring of 50 houses in Cranborne Rd, Potters Bar.

Conditions of Contract and Drawings may be inspected and copies of the Specification and Form of Tender can be obtained from the office of the Engineer and Surveyor, Wyllyotts Manor, Darkes La, Potters Bar, Middlesex, on receipt of a deposit of £2 2s, which will be refunded on the return of a bona fide Tender and the relevant documents. Sealed Tenders are to be submitted in the envelope provided and bearing no identification of the tenderer and endorsed "Tender for Electrical Re-wiring, Contract No. 1," must be delivered to the undersigned not later than 12 noon on Friday, 8 Dec., 1961.

The Council does not bind itself to accept the lowest or any Tender.

W. A. STEVENS,
Clerk of the Council.

Council Offices,
Darkes La,
Potters Bar,
Middlesex. (C 591)

### URBAN DISTRICT COUNCIL OF BRAINTREE AND BOCKING

**Street Lighting-Group "B" Stage IV**

TENDERS are invited on a FIXED-PRICE basis (that is without cost variation clauses for labour and materials) from Contractors experienced in the type of work for:

1. Taking delivery and erection of 81 No. Group "B" Prestressed Concrete Columns.
2. Supply, erection and wiring up of 78 No. 45/60 W Sodium Lanterns.
3. Supply, erection and wiring up of 4 No. Fluorescent Lanterns.
4. The laying of cable ducts across carriageways.
5. Removal of existing installations and incidental works.

Plans, Conditions of Contract and other documents may be inspected at the office of the Engineer, Town Hall, Braintree, who will also supply Specifications, Bills of Quantities and Tender Forms upon payment of a deposit of £2 2s, which will be refunded upon the receipt of a bona fide tender and all documents.

Tenders, in the plain sealed envelope provided, endorsed "Tenders—Street Lighting," must be delivered to the Clerk of the Council, Town Hall, Braintree, before 12 noon on Friday, 29 Dec., 1961. Specifications and priced Bills of Quantities must be returned at the same time in sealed envelopes bearing the Tenderers' name and address.

The Council do not bind themselves to accept the lowest or any tender.

W. BALSON,
Clerk of the Council.

Town Hall,
Braintree,
Essex. (C 613)

### COUNTY BOROUGH OF HASTINGS

**New Grammar School, Parkstone Road**

ELECTRICAL Contractors desirous of tendering for the electrical installation at the above are invited to submit their names to E. O. Baxter, M.ENG., A.M.I.C.E., Borough Surveyor, 37 Wellington Square, Hastings, together with a deposit of three guineas (returnable after the receipt of a bona fide tender) not later than 10 a.m. on Monday, 4 Dec., 1961.

Tender documents will be forwarded to applicants immediately they become available.

N. P. LESTER,
Town Clerk.

Town Hall,
Hastings. (C 602)

### N.A.T.O. COMMON INFRASTRUCTURE SLICE VIII

**Naval Base Installations**

FINAL notice is hereby given that International Competitive Bids will be invited on or about 2 April, 1962, for the supply and installation of the complete electrical installation for a P.O.L. storage depot to be constructed at Campbeltown, Scotland. Funds for this project were requested under N.A.T.O. paper AC/4(PP) D/3146.

The system will be 415 V, three-phase, four-wire, 50 c/s, A.C.

2. The approximate total value of the works is £50,000, and the contract will comprise flameproof and industrial equipment for the following purposes:

Power distribution and control, including switchgear, cables and starters.

Lighting of roads, tankage areas and jetty.

Power and Lighting in Buildings.

Oil pipeline heating system.

Earthing and bonding.

3. All the work will be carried out as one contract which will be undertaken as a subcontract within the framework of the Main Contract for the construction of the depot. Bids for the Main Contract have been invited.

4. It should be noted that the importation of labour from sources outside the United Kingdom may be subject to restriction and that permission could, in any case, only be given on an undertaking that the Contractor would pay rates of wages and observe hours and conditions of labour not less favourable than those established for U.K. labour for the trade or industry in the same area.

5. The closing date for the receipt of bids will be 5 June, 1962.

6. Firms wishing to bid for the whole of the electrical work must formally notify their desire by application to the address below by 2 Feb., 1962.

7. Within one week of the closing date for the receipt of applications to bid, firms wishing to be invited must forward the following information:

(i) Statement of financial resources and evidence of financial stability.

(ii) Details of recent major contracts completed for work of a comparable nature, including an indication of the value of each.

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8. Enquiries regarding bidding should be addressed to:

Director General, Navy Works,
Admiralty,
Chamberlain Way,
Pinner, Middlesex,
England.

quoting reference NWD/INFRA/19 (Electrical Installation). (C 592)

## APPOINTMENTS VACANT

### SOUTH EASTERN ELECTRICITY BOARD

INSTALLATION INSPECTOR

CRAWLEY AND HORSHAM DISTRICT

WAGES: 5s 11½d per hour for a 42-hour week under N.J.I.C. Agreement. Applicants should have a knowledge of the "Regulations for the Electrical Equipment of Buildings" of the Institution of Electrical Engineers and be able to inspect, test and connect all classes of installations; to attend to technical meter queries and to take maximum demand readings; to attend to pressure complaints and location of earth faults. Subject to certain conditions, housing accommodation may be available at Crawley.

Applications, quoting ET and naming two referees, to District Manager, Seeboard, 50-52 The Broadway, Crawley, by 4 Dec., 1961.

ELECTRICAL FITTER

BRIGHTON AND HOVE DISTRICT

Wages: 5s 6¾d an hour under N.J.I.C. Agreement for 42-hour five-day week. Optional superannuation scheme after two years' service. Applicants should be experienced in the erection and maintenance of H.V. and L.V. switchgear, transformers and asssociated gear.

Applications, quoting ET and naming two referees, to District Manager, Seeboard, Electric Hse, Castle Sq, Brighton 1, by 4 Dec., 1961.

SALES REPRESENTATIVE

EASTBOURNE DISTRICT

Salary under N.J.C. Grade 1, £600 x £25—£700 per annum. Superannuable. Applicants should have knowledge of domestic electrical appliances together with experience in selling and dealing with consumers' inquiries. Possession of E.D.A. Salesmanship Certificate would be an advantage. Duties include taking part in sales development and canvassing at consumers' premises. Successful applicant will be required to carry out duties in any Eastbourne district showroom when necessary.

Applications, quoting ET and naming two referees, to District Manager, Seeboard, Electric Hse, Grove Rd, Eastbourne, by 6 Dec., 1961.

DEMONSTRATOR

TUNBRIDGE WELLS DISTRICT

The successful applicant will be required to carry out demonstrations, advise consumers in their homes, instruct school children in the use and care of all types of electrical equipment. Possession of qualifications an advantage. The post offers good opportunities for early promotion to more senior work and salary. Salary in the range £600/£700 per annum under N.J.C. Grade 1. Superannuable.

Applications, quoting ET and naming two referees, to District Manager, Seeboard, Town Hall, Tunbridge Wells, by 6 Dec., 1961.

GEORGE WRAY,
Secretary.
(C 599)

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 46s. per inch, and all other classified advertisements at 3s. 6d. per line. Situations Wanted four insertions at twice the single insertion rate. Fee for Box Number and postage on replies 2s.

## FALKLAND ISLANDS GOVERNMENT

### South Georgia

ASSISTANT DIESEL ELECTRIC MECHANIC

REQUIRED for service in South Georgia for one tour of 2-2½ years in first instance. Salary £540 a year. Gratuity at rate of £10 for each completed month of residential service. Meals, furnished accommodation, fuel and lighting provided free. Liberal leave on full salary. Free passages. Candidates, single and under 40 years of age, must be able to repair and maintain diesel electric (a.c.) generators up to 75 kW and service electrical equipment. Apply to CROWN AGENTS, 4 Millbank, London S.W.1, for application form and further particulars, stating age, name, brief details of qualifications and experience and quoting reference M2/51446/EE. (C 578)

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SLB

THIRD ASSISTANT ENGINEER

(PLANNING)

SUB-AREA Office of No. 2 (Newbury) Sub-Area. Salary: N.J.B. Class M, Grade 10 (£1,275/£1,410 per annum). N.J.B. Conditions of Service.

The duties of the post will be to assist in the Planning Section principally on the detailed planning of, and scheduling of equipment for, major substations. Applicants should possess suitable technical qualifications.

Applications on forms obtainable from the Sub-Area Secretary, 7 Oxford Rd, Newbury, Berks, and returned to him, quoting Z.1437, not later than 4 Dec., 1961.

ASSISTANT ENGINEER

(SUBSTATION MAINTENANCE)

Bournemouth District of No. 4 (Bournemouth) Sub-Area. Salary: N.J.B. Class J, Grade 9 (£1,115/£1,245 per annum). N.J.B. Conditions of Service.

The duties of the post will be to assist with the maintenance of plant and equipment at outdoor and indoor substations on both urban and rural systems and to undertake standby duties. Candidates should have experience of the commissioning and maintenance of plant and equipment up to and including 33 kV. The possession of suitable technical qualifications will be an advantage.

Applications on forms obtainable from the Sub-Area Secretary, 1 Priory Rd, Bournemouth, Hants, and returned to him, quoting Z.1438, not later than 4 Dec., 1961.

ASSISTANT ENGINEERS

(SUBSTATION MAINTENANCE)

(TWO VACANCIES)

Southampton District of No. 4 (Bournemouth) Sub-Area. Salary: N.J.B. Class H, Grade 9 (£1,040/£1,165 per annum). N.J.B. Conditions of Service.

The successful candidates will be required to assist with the maintenance and operation of overhead and underground distribution systems up to and including 33 kV. Applicants should possess technical qualifications to at least H.N.C. level and should have had sound experience in the commissioning and maintenance of switchgear, transformers, protective systems and ancillary apparatus in a large industrial area. Standby duties will be involved.

Applications on forms obtainable from the Sub-Area Secretary, 1 Priory Rd, Bournemouth, Hants, and returned to him, quoting Z.1440, not later than 4 Dec., 1961.

ASSISTANT ENGINEER

(MAINTENANCE AND OPERATION)

Greenford District of No. 1 (Southall) Sub-Area. Salary: N.J.B. Class H, Grade 10 (£1,015/£1,140 per annum, inclusive of London Allowance). N.J.B. Conditions of Service.

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The duties of the post will be to assist with the maintenance and operation of switchgear, transformers, cables and overhead lines up to and including 11 kV. The appointment will involve standby duties.

Applicauons on forms obtainable from the Sub-Area Secretary, 2-6 Windmill La, Southall, Middx, and returned to him, quoting Z.1434, not later than 4 Dec., 1961.

GENERAL ASSISTANT ENGINEERS

(TWO VACANCIES)

Bournemouth District of No. 4 (Bournemouth) Sub-Area. Salary: N.J.B. Class J, Grade 12 (£890/£1,015 per annum). N.J.B. Conditions of Service.

Applicants should have had sound experience in the design, construction, operation and maintenance of H.V. and L.V. overhead and underground distribution mains and substations. The possession of suitable technical qualifications would be an advantage. The successful candidate will be required to carry out standby duties if and when called upon to do so.

Applications on forms obtainable from the Sub-Area Secretary, 1 Priory Rd, Bournemouth, and returned to him, quoting Z.1439, not later than 4 Dec., 1961.

GENERAL ASSISTANT ENGINEERS

(TWO VACANCIES)

Southampton District of No. 4 (Bournemouth) Sub-Area. Salary: N.J.B. Class H, Grade 12 (£825/£940 per annum). N.J.B. Conditions of Service.

The successful candidates will be required to assist principally with the maintenance and operation of H.V. and L.V. overhead and underground distribution systems up to and including 33 kV. Applicants should preferably possess suitable technical qualifications and sound experience in electricity supply distribution. Experience in the mains work associated with d.c. to a.c. changeover and voltage standardisation would be an advantage. Standby duties will be involved.

Applications on forms obtainable from the Sub-Area Secretary, 1 Priory Rd, Bournemouth, and returned to him, quoting Z.1441, not later than 4 Dec., 1961.

GENERAL ASSISTANT ENGINEER

Weymouth District of No. 4 (Bournemouth) Sub-Area. Salary: N.J.B. Class F, Grade 11 (£765/£870 per annum). N.J.B. Conditions of Service.

The duties of the post will be to assist in the maintenance and operation of the District's distribution network. The successful applicant will be required to undertake standby duties. Applicants should have had sound experience in the design, construction, operation and maintenance of H.V. and L.V. overhead and underground distribution mains and substations. The possession of suitable technical qualifications would be an advantage.

Applications on forms obtainable from the Sub-Area Secretary, 1 Priory Rd, Bournemouth, and returned to him, quoting Z.1442, not later than 4 Dec., 1961.

GENERAL ASSISTANT ENGINEERS

Construction Section, Sub-Area Engineering Department of No. 3 (Portsmouth) Sub-Area. Salary: N.J.B. Class L, Grade 17 (£715/£805 per annum). N.J.B. Conditions of Service.

The duties of the post will be to assist with the installation and erection of plant, equipment and overhead lines, the laying of cables and other constructional work on all distribution systems, up to and including 33 kV.

Applications on forms obtainable from the Sub-Area Secretary, Lower Drayton La, Cosham, Portsmouth, and returned to him, quoting Z.1426, not later than 4 Dec., 1961.

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The successful candidates for the above appointments will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible. (C 606)

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## CENTRAL ELECTRICITY GENERATING BOARD

### North Eastern Region

FOURTH ASSISTANT ENGINEER (SECTION)

TRANSMISSION DEPARTMENT

NORTON SECTION

APPLICATIONS are invited for the position of Fourth Assistant Engineer (Section) in the Norton Section of the Transmission Department, with Headquarters at Norton Switching Station, near Stockton-on-Tees.

The successful applicant will be required to assist in the operation and maintenance of 275 kV, 132 kV and 66 kV overhead lines and substations. Previous training with a large manufacturer of E.H.T. switchgear and transformers is desirable, and experience on maintenance of overhead lines will be an advantage.

Applicants should have had a good general education and possess a Higher National Certificate in Electrical Engineering, or an equivalent qualification.

The salary for the appointment (which is superannuable) will be in accordance with the National Joint Board Agreement, Class K, Grade 9 (£1,050/£1,325 per annum), and will commence at a point commensurate with qualifications and experience.

Forms of application may be obtained from the Regional Personnel Officer, Central Electricity Generating Board, North Eastern Region, 1 Whitehall Rd, Leeds 1, to whom they should be returned to arrive not later than 9 Dec., 1961. (C 608)

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## AIR MINISTRY WORKS DEPARTMENT

MECHANICAL AND ELECTRICAL

ENGINEERS

OPPORTUNITIES OVERSEAS

APPLICATIONS invited from Assistant Mechanical and Electrical Engineers for appointments initially in overseas areas on tours of two or three years' duration according to location. Completion of tour is followed by duties in U.K. with every opportunity for further tours overseas.

SALARY overseas includes FOREIGN SERVICE ALLOWANCE, which varies according to location and whether single or married. For example, total emoluments in Cyrpus at age 25, range at present from £1,316/£1,766 (single) and from £1,676/£2,301 (married). Annual increments to age 38 with a special increase of £95 p.a. for fully qualified men after two years' service.

DUTIES comprise design, construction and maintenance of installations in workshops and on airfields, radar stations and maintenance units, etc.

QUALS. At least the qualifying examination for corporate membership (or exemption) of the Institution of Electrical Engineers or the Institution of Mechanical Engineers (with appreciable electrical engineering experience) and not less than two years' professional experience.

CONDITIONS. Expatriation and kit allowances (£85/£140 approx.). Free passage overseas for self and later for family when accommodation arranged. Free medical and child educational arrangements. Five-day week with paid annual leave initially four weeks and two days. Paid sick leave within certain limits.

PROSPECTS. Appointments are non-pensionable but retirement/resignation gratuity payable after five years' or more service. Excellent opportunities of obtaining permanent pensionable post (with all service counting) and of advancement to posts in the higher grades which number 180 approx. Higher grade salaries vary between £1,456 and £3,715 p.a. and vacancies are, as a rule, filled by promotion of existing staff.

Applicants, who must be natural born British subjects under 35 years of age, should write to Air Ministry Works Department (W.G.d), Lacon Hse, Theboalds Rd, London W.C.1. Selection will be by interview in London and certain expenses will be reimbursed. (C 394)

**CENTRAL ELECTRICITY GENERATING BOARD**

**West Midlands Division**

SHIFT CHARGE ENGINEER

REQUIRED at Hams Hall "B" Power Station, near Birmingham. N.J.B. service conditions, superannuable appointment, salary within Schedule A, Grade K6, £1,440/£1,610 per annum, plus 10% shift allowance.

A sound technical training and practical experience in the operation and maintenance of steam generating plant and main switchgear in a large modern power station are required, also a knowledge of P.F. firing. The station is one of advanced design. Appropriate qualifications an advantage.

Apply, quoting Vacancy No. 276/61 MR on Form AE6, available from the Station Superintendent, Hams Hall Power Station, Lea Marston, Sutton Coldfield, Warks, by 4 Dec., 1961. (C 607)

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**SOUTH OF SCOTLAND ELECTRICITY BOARD**

HOUSECRAFT ADVISER

APPLICATIONS are invited for the above superannuable post which will be based on a large Showroom to be opened shortly in Glasgow.

Applicants must be fully experienced in public demonstration work, be capable of supervising a large demonstration theatre, and of training young demonstrators. A domestic science qualification and a thorough knowledge of modern electrical appliances are essential. Sales experience will be an advantage, as also will be the E.A.W. Demonstrator's Certificate.

Salary: £780/£880 per annum (N.J.C. Grade 3).

Applications, giving age, experience, qualifications, and quoting reference C.27/61, should be sent to the Secretary of the Board, Inverlair Ave, Glasgow, not later than 1 Dec., 1961. (C 585)

**SCULL ELECTRICAL LIMITED**

require

## SENIOR ELECTRICAL ENGINEER

This is a new post and the successful applicant will be responsible for a team of assistants within a growing Department. Applicants should have served an apprenticeship in Electrical Contracting and have wide experience in the preparation of Designs, Specifications and Competitive Estimates for Electrical Installations up to £100,000 in value.

## SENIOR CONTRACTS ENGINEER

Applicants should have served an apprenticeship in Electrical Contracting and have experience of labour control, ordering materials and running contracts up to £100,000 in value. This is a new post to strengthen an expanding Contracts Department and excellent opportunities and a car are offered.

Both these appointments carry an attractive four-figure salary, pension scheme and ample opportunities for advancement in an expanding Company.

Applications, which will be treated in strict confidence, to:

**The Managing Director,**
**Scull Electrical Limited,**
**Redcliffe House,**
**Bristol 3.**

(C 604)

**THE NORTH WESTERN ELECTRICITY BOARD**

SECOND ASSISTANT ENGINEER

SUB-AREA COMMERCIAL DEPARTMENT

BLACKBURN

THE person appointed will be required to exercise general supervision over the Installation Contracting Sections in the Sub-Area and to assist in industrial and commercial load development. Experience in design and the preparation of specifications and plans for all classes of electrical installations and the supervision of staff and manual workers is essential.

Corporate Membership of the Institution of Electrical Engineers would be an advantage.

Salay Scale: £1,440/£1,610 p.a., Grade L.7, N.J.B. Conditions.

Applications on forms to be obtained from the Manager, No. 5 Sub-Area, The North Western Electricity Board, Jubilee St, Blackburn, and returned to him by 4 Dec., 1961. (C 586)

**OVERHEAD TRANSMISSION LINE ENGINEERS**

Large contracting organisation has vacancies for AGENTS, SUB-AGENTS and ENGINEERS on 275 kV and 132 kV Steel Tower and Wood Pole Line Contracts in Scotland. State age and give full particulars of experience to Box No. 577, Keith and Co., 11 Castle St, Edinburgh. (C 528)

**CROMPTON PARKINSON**
**(CHELMSFORD) LIMITED**

require a

## SENIOR TEST ENGINEER

An experienced man, conversant with the testing of medium sizes a.c. and d.c. machines is required in our rotating machine test section. Applications should be sent in confidence to:

**Personnel Officer,**
**Crompton Parkinson (Chelmsford) Ltd.,**
**Writtle Rd,**
**Chelmsford, Essex.**

(C 566)

**THE SOUTH WALES ELECTRICITY BOARD**

ASSISTANT ENGINEER

APPLICATIONS are invited for the position of Assistant Engineer in the Pembrokeshire District (Haverfordwest) of the West Wales Area.

Preference will be given to Engineers possessing the Higher National Certificate in Electrical Engineering, and a sound technical training on overhead and underground H.V. and L.V. systems is desirable.

Salary: Class F, Grade 9, Scale 6 (£890/£1,015 per annum).

Applications stating age, present position, present salary, qualifications and experience, should be addressed to E. Broughton, A.M.I.E.E., Manager, West Wales Area, South Beach Pavilion, Tenby, to arrive not later than 9 Dec., 1961.

Please quote reference 143/61/ET, endorsing envelope "Assistant Engineer."

R. G. WILLIAMS,
Secretary.
(C 597)

**FREDERICK S. SNOW**
**& PARTNERS**

**CONSULTING ENGINEERS**

invite applications for

## *ELECTRICAL ENGINEERS*

to work on a wide range of Industrial and Commercial Projects in their Electrical and Mechanical Department.

Applicants should preferably have practical experience in Electrical Installation Design in buildings, and hold National Certificate or equivalent qualifications.

The organisation has a superannuation scheme and luncheon voucher facilities.

Details of education, training, age, and experience should be sent in confidence to:

**Ross House,**
**144 Southwark Street,**
**London S.E.1.**

(C 588)

## CENTRAL ELECTRICITY GENERATING BOARD

## SOUTHERN PROJECT GROUP

## Bankside Power Station

Applications are invited from suitably qualified and experienced engineers for the post of THIRD ASSISTANT ENGINEER (MECHANICAL) at Bankside Power Station Construction Site.

The successful candidate will be required to assist the Site Mechanical Engineer in the supervision of the installation and testing of mechanical engineering plant. Experience in the supervision of construction of major engineering works and in the installation of power station plant would be an advantage.

The salary will be within Scale 13 of the National Joint Board Agreement, i.e., £1,320 to £1,610 per annum, plus £60 London Allowance according to qualifications and experience.

Applications stating age, qualifications, experience present position and salary should be forwarded to the Administrative Officer, Central Electricity Generating Board, Southern Project Group, Squires Lane, Finchley, London N.3, to arrive not later than Monday, 4 December, 1961.

Envelopes should be marked "Confidential—ref.: S/61/27."

T. YULE,
Chief Project Engineer.

(C 582)

**W. H. ALLEN, SONS & CO. LTD.**

have a vacancy for a

## SALES ESTIMATING AND CONTRACTS ENGINEER

in their

**ELECTRICAL DEPARTMENT**

Candidates should be between 24-35 years' old and possess at least an H.N.C. in Electrical Engineering or equivalent. The work will cover proposals involving A.C. and D.C. generators and motors, switchgear and control gear for Land and/or Marine applications. Salary according to experience and qualifications.

Application forms, etc., can be obtained from:

**THE PERSONNEL MANAGER, (Ref. 507/2/2)**
**Queen's Engineering Works, Bedford.**

(C 603)

**CENTRAL ELECTRICITY GENERATING BOARD**

**North Eastern Region**

REGIONAL ELECTRICAL DEPARTMENT

FOURTH ASSISTANT ENGINEERS

(PLANNING)

APPLICATIONS are invited from suitably qualified engineers for positions as Fourth Assistant Engineers in the System Planning and Development Section of the Regional Technical Branch at Leeds. The successful candidates will be required to assist with system studies employing a.c. and d.c. calculators, and with planning extensions to the transmission system.

The salary for these appointments will be in accordance with the National Joint Board Agreement, Class K, Grade 9, 10 or 11 (£900/£1,325 per annum), according to qualifications and experience.

Forms of application may be obtained from the Regional Personnel Officer, Central Electricity Generating Board, North Eastern Region, 1 Whitehall Rd, Leeds 1, to whom they should be returned to arrive not later than 4 Dec., 1961. (C 563)

**KWAME NKRUMAH UNIVERSITY OF SCIENCE & TECHNOLOGY**

**Kumasi-Ghana**

APPLICATIONS are invited for the post of

STRUCTURAL ENGINEER

in the Architects' Office under the direction of the Senior Architect.

**Qualifications:** Candidates must be Graduate members of the Institution of Structural Engineers or must possess similar qualifications. In addition, they must have had at least three years' practical experience after gaining qualification.

**Duties** will include advising on, designing, detailing and supervision of structures in connection with the University buildings, preparation of bending schedules, and such other work that would normally be handled by a Consultant Structural Engineer.

Appointments are normally for five years and may be renewed; three months' notice of resignation or termination of an appointment is required on either side.

CONTRACT SALARY SCALES ARE:

Expatriate: £1,386 x £66—£2,508.

Ghanaian: £1,156 5s/£2,031 5s.

Children's allowances are paid in respect of Expatriates up to a maximum of five at the rate of £50 per annum per child up to the age of ten years and £100 per annum per each dependent child over ten years of age in full-time education up to a maximum of 21 years of age.

The University is fully residential and members of staff are normally housed in

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pleasant modern bungalows on the spacious campus; climate and living conditions are good.

Annual leave with three free return passages in four years is granted to members of staff and their families.

Application forms may be obtained from the Assistant Registrar, Kwame Nkrumah University, 29 Tavistock Sq, London W.C.1, who will also be glad to answer any questions about living conditions in Ghana. Completed application forms in triplicate, together with two recent testimonials, should reach him not later than 26 Dec., 1961. (C 596)

## Eastern Electricity

**Suffolk Sub-Area**

IPSWICH DISTRICT

SENIOR DEMONSTRATOR

APPLICANTS should have had a sound training in Domestic Science and hold a recognised diploma. They should be capable of arranging and giving talks on domestic electrical subjects to women's organisations, school authorities and groups of students.

The duties of the post will include the supervision of staff and to assist in building the domestic load by studying new housecraft techniques and new electrical appliances and by helping housewives directly and indirectly to select, buy and use efficiently the appliances most suited to their needs.

Salary: N.J.C. 2, £700/£775.

Apply by letter to R. A. Jackson, Esq., A.M.I.E.E., A.M.B.I.M., Manager, Ipswich District, Eastern Electricity Board, Electric Hse, Ipswich, Suffolk, by 4 Dec., 1961.

**Northmet Sub-Area**

GENERAL ASSISTANT ENGINEER

(ENGINEERING DRAUGHTSMAN)

CIVIL ENGINEERING AND BUILDING SECTION

SUB-AREA ENGINEER'S DEPARTMENT

(Ref. 1093) 241/61.R.

Candidates should be capable of preparing plans, estimates and detailed drawings associated with Civil Engineering and Building Works.

Possession of an Ordinary National Certificate or equivalent qualification is desirable.

Salary: N.J.B. Class N, Grade 18 (£815/£920) including London Allowance.

Apply by letter to the Manager, Eastern Electricity Board, Northmet Sub-Area, Northmet Hse, Southgate, London N.14, by 8 Dec., 1961.

**Chilterns Sub-Area**

FOURTH ASSISTANT ENGINEER

NORTHWOOD DISTRICT

240/61.R.

Candidates should have had a sound technical training and experience in the construction, operation and maintenance of H.V. and L.V. underground systems, including substations.

Salary: N.J.B. Class G, Grade 11, £875/£990, including London Allowance.

Apply by letter to the Manager, Northwood District, Eastern Electricity Board, 1 Love La, Pinner, by 8 Dec., 1961.

**Chilterns Sub-Area**

THIRD ASSISTANT ENGINEER

BEDFORD DISTRICT

242/61.R.

Candidates should have had a sound technical training and suitable experience in the construction, operation and maintenance of H.V. and L.V. overhead and underground distribution systems including substations.

Salary: N.J.B. Class G, Grade 9, £965/£1,090.

Apply by letter to the Manager, Bedford District, Eastern Electricity Board, Prebend St, Bedford, by 8 Dec., 1961. (C 595)

**UGANDA GOVERNMENT**

**Public Works Department**

INSPECTOR OF WORKS (ELECTRICAL)

REQUIRED. Appointment on contract for one tour of 21-27 months in first instance. Salary according to age and experience in scale (including Inducement Pay) rising to £1,671 a year. Gratuity 25% of total salary drawn. Outfit allowance £30. Children's education allowances. Free passages. Liberal leave on full salary.

Candidates should be 29-40 years of age, and must possess at least O.N.C. (Electrical) or equivalent qualification. They should also have served a full apprenticeship and had subsequent experience in maintenance of industrial electrical equipment and large installations. They must be fully conversant with U.K. Home Office Electricity Rules, Electricity Regulations under the Factories Act and those of the Electrical Commissioners.

Apply to CROWN AGENTS, 4 Millbank, London S.W.1, for application form and further particulars, stating age, name, brief details of qualifications and experience and quoting reference M2/50987/EE. (C 576)

## MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts:

**Birmingham Area**

ENGINEERING DRAUGHTSMAN

(GENERAL ASSISTANT ENGINEER)

(AREA OFFICE)

Applicants should have experience in the preparation of drawings in connection with the layout of high voltage and medium voltage switchgear, cables, etc., and preparation of mains records for an extensive high voltage and medium voltage overhead and underground distribution system. Salary within the ranges £765/£870, £825/£940, £890/£1,015, £965/£1,090, £1,040/£1,165 per annum (N.J.B. Grades N.18 to 14), according to qualifications and experience. Apply, by letter, within seven days, stating age, experience, qualifications, present position and salary, to Emil Braathen, Area Manager, Midlands Electricity Board, 14 Dale End, Birmingham 4.

**South Staffs and North Worcs Area**

SECOND ASSISTANT DISTRICT ENGINEER

(DUDLEY)

Applicants should have had experience in all branches of district work including the installation, operation and maintenance of high and low voltage cables, switchgear and transformers. Technical qualifications desirable. Salary: £1,190/£1,325 per annum (N.J.B. Grade H.7). Apply, by letter, within ten days, stating age, qualifications, experience, present position and salary, to Mr D. Holt, Acting Area Manager (Ref. EMI/SEC), Midlands Electricity Board, P.O. Box No. 9, Toll End Rd, Tipton, Staffs.

**Worcestershire Area**

THIRD ASSISTANT DISTRICT ENGINEER

(EVESHAM)

Experience necessary in all branches of distribution work including construction maintenance and operation of high and low voltage underground and overhead systems and substations. Technical qualifications desirable. Salary: £890/£1,015 per annum (N.J.B. Grade F.9). Apply, by letter, within 14 days, stating age, experience, present position and salary, to District Manager, Midlands Electricity Board, 64 High St, Evesham.

F. W. CATER,
Secretary.
(C 584)

## SOUTH OF SCOTLAND ELECTRICITY BOARD

DEMONSTRATOR

APPLICATIONS are invited for the above superannuable position in a large Showroom to be opened shortly in Glasgow.

Applicants must be experienced in presenting public demonstrations, and capable of assisting the Senior Demonstrator in supervising the theatre and training staff. A knowledge of electrical appliances is necessary, as also is a domestic science qualification. Sales experience will be an advantage.

Salary: £600/£700 per annum.

Applications giving age, details of experience, qualifications, etc., and quoting reference C.28/61, should be submitted to the Secretary, South of Scotland Electricity Board, Inverlair Ave, Glasgow S.4, not later than 1 Dec., 1961. (C 600)

## UNIVERSITY OF NOTTINGHAM

**Manager for Applied Science Faculty Workshops**

APPLICATIONS are invited for the appointment of Manager of the newly established mechanical and electronics workshops for the production of scientific equipment for teaching and research. A staff of 50 workmen is planned. Candidates should have served a recognised engineering apprenticeship and have corporate membership of a professional Engineering Institution. Salary scale £1,475/£1,850, initial salary according to qualifications and experience, plus membership of the Universities' Superannuation Scheme and family allowance. Application form and conditions of appointment, to be returned by 31 Dec., 1961, from the Registrar. (C 614)

## LONDON ELECTRICITY BOARD

GENERAL ASSISTANT ENGINEER

APPLICATIONS are invited for the above position. Initially, the successful candidate will be located at 255-279 Cambridge Heath Rd, Bethnal Green, E.2.

Applicants should have a sound technical education to the standard of the Higher National Certificate, and have completed a recognised period of training in the Electricity Industry, or have equivalent experience.

The post is graded under Schedule A of the National Joint Board Agreement, Class K (Area), as Grade 15, £725/£920 per annum inclusive of London Allowance.

Applications should be sent to the Manager, East End District, 255-279 Cambridge Heath Rd, Bethnal Green, E.2, within 14 days of the publication date of this notice. Please quote ref.: PER/V/3436/T. (C 598)

## NORTH WEST METROPOLITAN REGIONAL HOSPITAL BOARD

MAIN GRADE ENGINEER (ELECTRICAL)

REQUIRED. Applicants should be A.M.I.E.E., but graduate members will be considered provided they have passed the Institution Examination of the Institution of Electrical Engineers.

The post is permanent and superannuable. The Board operate a scheme of financial assistance for those studying for approved professional qualifications.

Salaries will be within the range of £950/£1,650. It is possible for Corporate Members to enter at a salary point up to a maximum of £1,350 and graduate members at a point up to a maximum of £1,255, in respect of years of relevant experience since completing the appropriate Institution's examination.

Apply, stating age, qualifications (with dates) and experience, with the names of two referees, to the Secretary, North West Metropolitan Regional Hospital Board, 40 Eastbourne Terr, London W.2, quoting reference 999 by 4 Dec. (C 575)

## CENTRAL ELECTRICITY GENERATING BOARD

**West Midlands Division**

ASSISTANT SHIFT CHARGE ENGINEER

REQUIRED at Meaford "A" Power Station, nr. Stone, Staffs. N.J.B. service conditions, superannuable appointment, salary within Schedule A of the Agreement, Grade G.9, £965/£1,090 per annum, plus 10% for shift duties.

Applicants should have received a sound technical training and practical experience in the operation and maintenance of steam generating plant and main switchgear, and a knowledge of P.F. firing is desirable. Appropriate technical qualifications would be an advantage.

Apply, quoting Vacancy No. 272/61 MR, on Form AE6, available from the Station Superintendent, Meaford Power Station, nr. Stone, Staffs, to be completed and returned by 4 Dec., 1961. (C 594)

## MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

Staff Vacancy Notice.

FOURTH ASSISTANT ENGINEER

(PLANNING AND DEVELOPMENT)

REQUIRED at No. 3 Sub-Area Headquarters, Chester. Salary: £890/£1,015 per annum (N.J.B. K/13).

Applicants should have had experience on the designing of H.V. and M.V. distribution networks and associated equipment, and possess suitable technical qualifications.

Appointment subject to medical examination. Pension scheme.

Applications on forms obtainable from the Manager, No. 3 Sub-Area, Merseyside and North Wales Electricity Board, Newgate St, Chester, must be forwarded not later than 5 Dec., 1961. (C 612)

## SOUTH WESTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following position:

THIRD ASSISTANT DISTRICT COMMERCIAL ENGINEER

(INDUSTRIAL AND COMMERCIAL DEVELOPMENT)

PLYMOUTH

Salary within Class H, Grade 9, Salary Scale 8, £1,040/£1,165 per annum, of the N.J.B. Agreement.

The successful candidate will be responsible to the First Assistant District Commercial Engineer (Contracting) for industrial and commercial development, with particular reference to the development of thermal storage installations.

A knowledge of heat loss calculations and heating design techniques is essential. Possession of qualifications equivalent to the Higher National Certificate in Electrical Engineering is desirable, as is possession of a current driving licence.

Applications to be made on Standard Form AE6/ACT, OBTAINABLE BY POSTCARD ONLY, from the District Manager, South Western Electricity Board, Elliott Rd, Prince Rock, Plymouth. Closing date for receipt of completed applications is 9 Dec., 1961. (C 610)

## LONDON ELECTRICITY BOARD

ENGINEER (TEST)

METER AND TEST BRANCH

CHIEF ENGINEER'S DEPARTMENT

APPLICATIONS are invited for the above position at Lesco Hse, Stamford St, London S.E.1.

Duties include statistical and experimental investigations into protective gear performance and assisting in the development of schemes and apparatus for special applications.

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continued in next column

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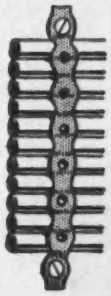

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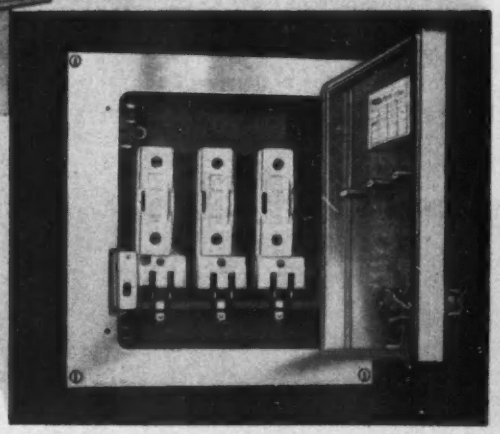

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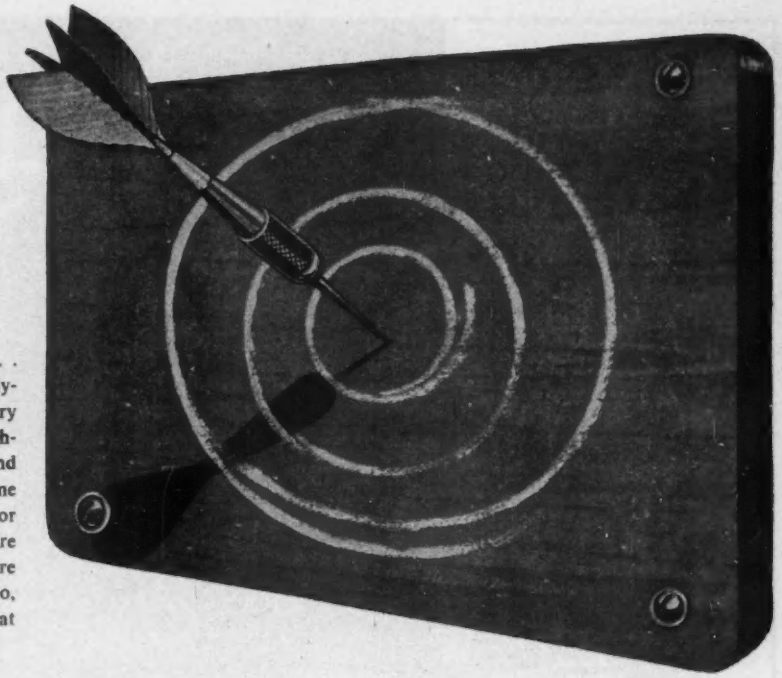

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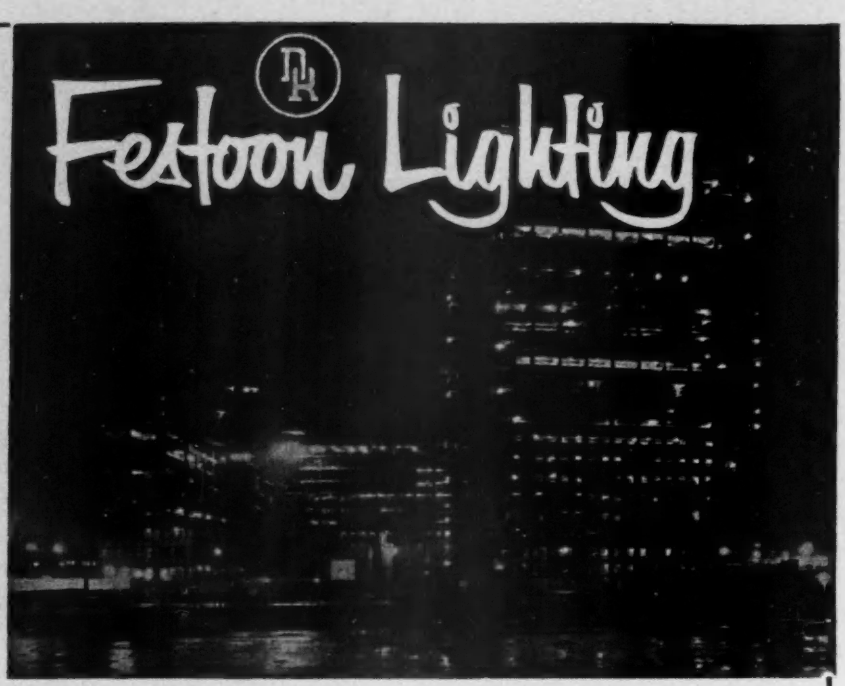


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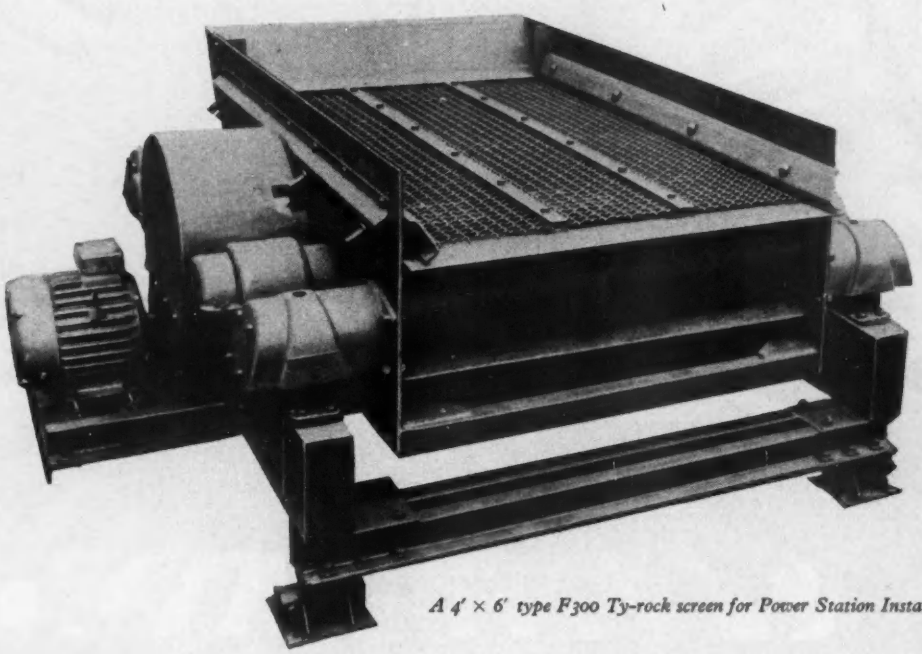

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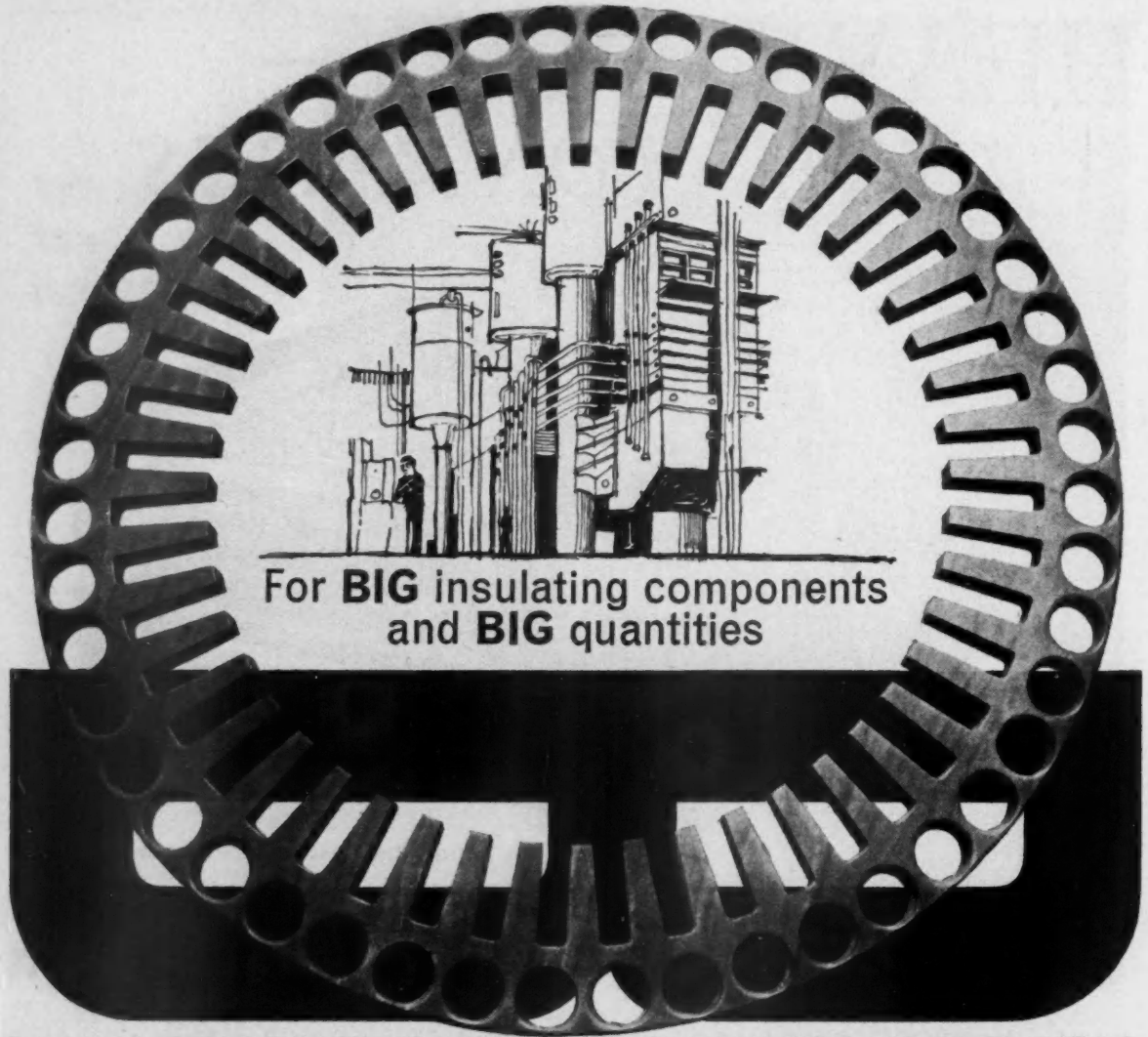


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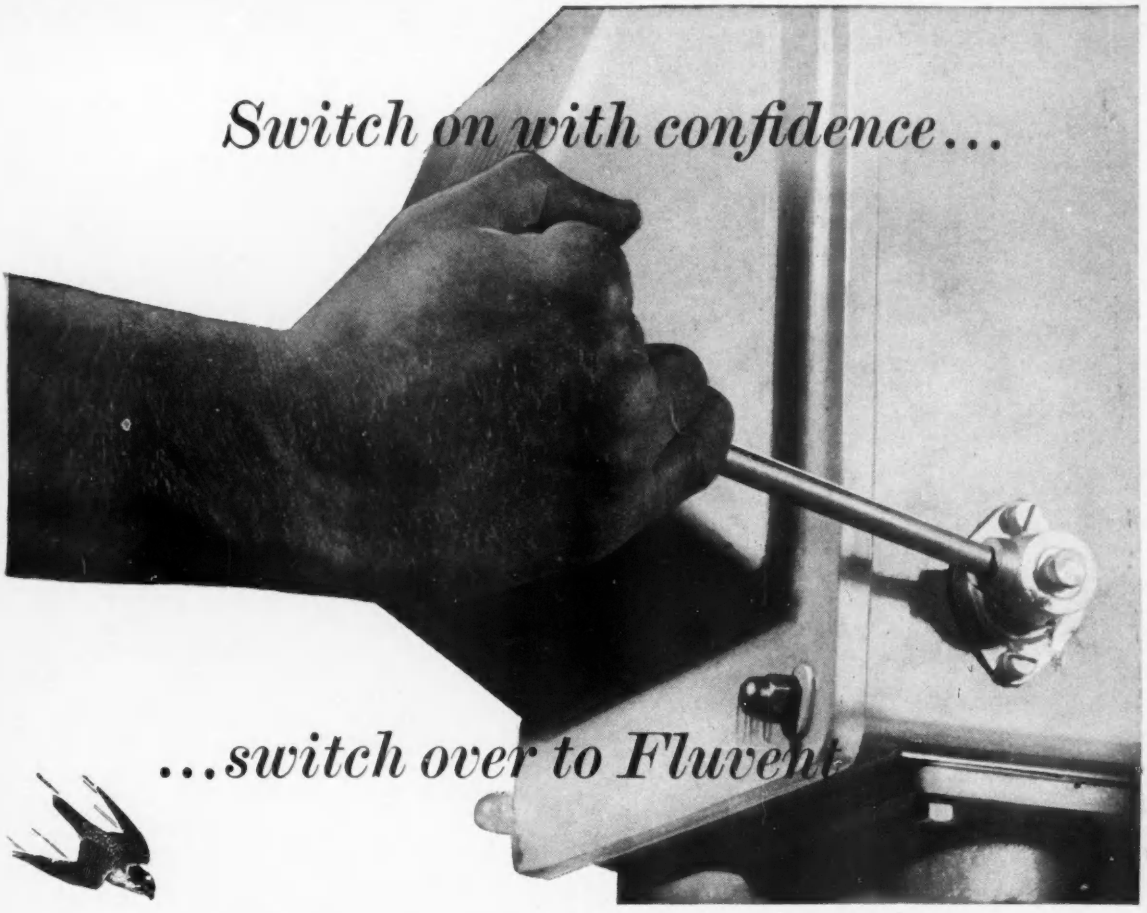


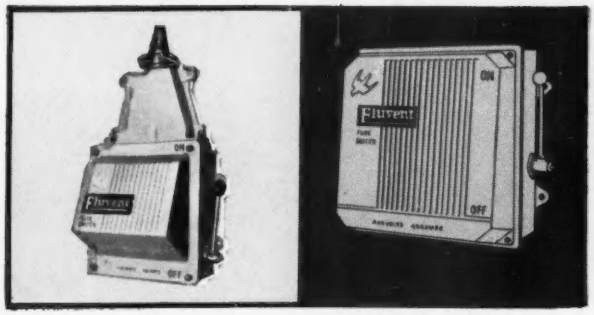


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